Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 71 New York, Saturday, February 9, 1918 *Number* 6

Electricity a Factor in Increasing Coal Production

COAL shortage has not been without its redeeming feature so far as the electrical industry is concerned. In the anthracite region, especially where labor shortage is a handicap, operators have turned to machinery to increase production, and it is of interest to note that no other class of material has been in so great demand as electrical equipment. Had manufacturers been able to make deliveries, 1917 would have been a banner year. Shovels, hoists, drives, haulage systems, pumps, blowers and other machinery are being equipped more than ever with electric motors. The cry is for electric power, and central stations throughout the coal regions are now not hunting for markets but for equipment to keep up with load requirements. Electricity has maintained its reputation; production has been increased despite 15 per cent labor shortage, and, more than that, low beds can now be mined profitably.

Central Stations Should Take Nothing for Granted

HOUSING of the army of workers necessary at shipyards and other places engaged in war work is one of the serious problems confronting the government. In the model communities already erected all the homes have been equipped with electricity, not because of any special urging by the electrical industry but because the designers feel that electricity is the proper thing. Some day, however, the gas companies may show enterprise and these new communities and cities may be won over to the use of gas for illuminating, heating and cooking purposes. It is not wise, therefore, for the central-station industry to take anything for granted. The tortoise has been known to outrun the hare.

Constructive Criticism Needed on Water-Power Bills

WITHIN a very short time hearings will be held on water-power bills now before Congress. It is not expected that any new light will be thrown on the general proposition, for there is no subject before Congress that has been more talked of, at and for during the last decade. The need is recognized by all, and the opportunity for the passage of a constructive measure was never more favorable. But if a deadlock between the Senate and House is to be avoided—a consummation devoutly to be wished—factional differences must in large measure be put aside. The so-called "administration" bill admittedly offers a simple solution of the water-power legislation problem and is an improvement over other measures. It seeks to protect the rights of the public and at the same time to offer private capital adequate security for its investment. In short, it is 90 per cent good and the other 10 per cent is not irremediably bad. If, therefore, constructive criticism be offered on the minor defects of the measure, due allowance being made for honest and irreconcilable differences, a satisfactory compromise on these detail features may be effected and the necessary legislation finally enacted. To defer action longer on our water powers would in itself be criminal, and to damn the "administration" measure because of any slight imperfections, and thereby wreck all hope of a reasonably fair bill, would be more so.

Concrete Poles in Power Distribution

THE use of reinforced concrete for electric line poles is not new, but the example which we describe this week is in several respects somewhat out of the ordinary. The case in which poles were required was for a private distribution line to seven pumping plants in California. The transmission to be accomplished was at 22,000 volts and the aggregate power demanded 2800 hp. In this case the permanency of the installation, with perhaps somewhat greater security against line trouble, was the deciding factor in the choice of reinforced concrete. The poles were designed as square, tapered beams, reinforced symmetrically on two sides. For economy of material two sizes of poles were designed, the heavier ones to be used at each substation and for every fifth pole on the line as well as at crossings. The lighter poles served for the remainder of the work. The spacing adopted varied from 250 ft. to 390 ft. (76.2 m. to 118.9 m.).

A striking feature of the construction is that the cross-arms were molded with the poles and the whole work of molding was done on the ground on account of the great weight of the finished pole, averaging about 4 tons. The forms were laid out horizontally, reinforcement was suspended in place, and the concrete was hand-mixed and molded into them. In the cross-arms the reinforcing is of steel angle irons, which carry the insulator pins directly so that even were the concrete to be broken from the arms the stability of the conducting system would not be disturbed. After completion the poles were erected by a double derrick mounted on a dray. The derrick was put in position, the pole caught just above its center of gravity by a chain sling, and the pole lifted on end and dropped into its hole. The average cost per pole erected was a little

less than $70, divided with fair equality between material and labor. The poles were designed with a high factor of safety, in fact so as to withstand a 90-mile (144.8-km.) wind with all the wires on one side broken, a condition thought considerably more severe than is likely to be actually encountered in the operation of the system. It is safe to say that so far as the strength and stability of the poles go that particular line will be immune from trouble due to wind and weather for a long time to come.

A Step Toward Synchronous Operation

OPERATING engineers will be interested in a brief account we publish this week of the line-synchronizing stations of the Central Illinois Public Service Company. Two such stations have recently been erected to facilitate the interconnection of two branches of the great system, each comprising about 250 miles (402 km.) of 33,000-volt network. Previous to this installation the lines did not generally operate in parallel, and when it became necessary to do so synchronizing at one of the distant stations involved some time and annoyance. Just why these two networks have not regularly been tied in in parallel it is a little hard to see, but there are many such cases of neglected opportunity, and it is altogether pleasant to see the obvious step toward unified distribution being so effectively taken, especially at this time when every effort is being made to conserve fuel, labor, capital and equipment and still keep up the standards of service.

It was found in every-day practice that it took twenty minutes or so of juggling load and frequency, via long-distance telephone, to make the interconnection successfully. As the necessity for parallel operation grew, the present improvement was made. Two simple stations with synchronizing apparatus have been put out on the lines at the necessary interconnection points. Their arrangement is of the simplest possible character. Provision is made for interconnection of the apparatus and for cutting out a necessary section for repairs or inspection. For still further simplicity the synchroscopes used are of the electrostatic variety, which are found to operate admirably and give practically a considerable advantage in the absence of costly instrument transformers and their numerous accessories.

For this reason alone the installation of the electrostatic instrument saved more than $500 in each of these synchronizing stations. As time goes on, the necessity for such stations is likely to increase. Larger and larger networks would be normally operated in parallel, as many of them are to-day. It may be necessary now and then, under these circumstances, to split off certain sections of the network while still keeping them in operation, for the sake of convenience in repairs or dealing with certain emergencies of load. It is then a great convenience to be able to synchronize and reunite these sections at any convenient point in the shortest time possible. Such special synchronizing stations, therefore, as those here described, under the control of the load dispatcher, may serve an exceedingly useful purpose, and the complete simplicity of the layout should encourage its more frequent use.

The Inductance of Long Reactance Coils

IN ELECTRICAL engineering one of the devices most frequently encountered is a coil of insulated wire. There are all kinds of coils. Their name is legion but they all have inductance. Their inductance is often a property of preponderating importance in the behavior and use of the coil. From the standpoint of inductance all coils may be divided into two classes, namely, those having magnetic cores and those having non-magnetic cores. The inductance of coils containing magnetic cores is so complicated, and depends on so many factors, that, in the discussion of their behavior, the conception of inductance is commonly relinquished. On the other hand, the inductance of coils with non-magnetic cores is a very valuable property, from the technical standpoint. It ordinarily remains nearly constant over a wide range of operating frequencies and current strengths.

For many purposes it is important to predetermine the inductance of a coil of given dimensions during the stage of its design and in advance of its construction. The conception of the inductance of an air-cored coil is easy. If we suppose that 10 amp. or 1 absampere of current flows steadily through the coil, we may imagine that all the magnetic flux lines or maxwells become visible to the eye and can be counted. Actually, of course, we can only visualize these flux lines in the mind's eye with the aid of pictures obtained from scattered iron filings. If now we count, in imagination, all the maxwells linking through each turn of the coil, the sum total of all these linkages for all the turns in succession will be the total inductance of the coil, expressed in abhenries.

The numerical realization of the inductances of such coils is, however, mathematically difficult, owing to the complexity in the distribution of the magnetic fluxes linked with them. Only in certain easy cases, such as closed circular solenoids or very long simple helices, is the formula a simple one. Various formulas have been published for different degrees of approximation, some simple and others more complex.

The article by H. B. Dwight this week on the subject is of considerable interest. He divides all non-magnetic-cored reactance coils into long coils, short coils and flat coils. The "longs" have their lengths greater than their mean diameters. The "shorts" have their lengths less than their mean diameters but greater than their radial winding thicknesses. The "flats" have their lengths less than their radial winding thicknesses. This seems to be a useful basis for classification. The article supplies engineering formulas for the long coils only, it being the author's intention to discuss short coils later. The formulas are rather long, but they are definite and easily worked out, as is evidenced from the two problems which are cited in the text of the article by Mr. Dwight.

Incidentally it is noticeable that it is advantageous from an engineering standpoint to measure the dimensions of a coil in centimeters rather than in inches, and to express the inductance in abhenries rather than in henries, in order to obtain the simplest formulas. By this means, as the article indicates, certain constants perpetually appearing in the arithmetic can happily be eliminated.

Power at the Mine's Mouth

FOR a good many years past engineers with large vision of the future have dreamed and preached about the electrical transmission of power on a large scale from cheap coal burned at the very mine itself. Out of it all little has come until very recent years, but to-day the projects for great networks fed from colossal generating stations and supplying the varied industries of a huge territory loom large on the horizon. They are beginning to come to realization, and it is a pleasure to give in our columns this week some further account of the first great system of the kind to undertake the fulfillment of its mission in the United States. The Windsor plant lies in the load center of the great manufacturing district concentrated in eastern Ohio, western Pennsylvania and the adjacent corner of West Virginia. From a physical standpoint the location is an exceptionally good one, too, inasmuch as an ample supply of good coal is available from a mine adjacent to the station. To-day it has a capacity of 60,000 kw. in two huge units, with four more to be added in the near future, two of them within the current year.

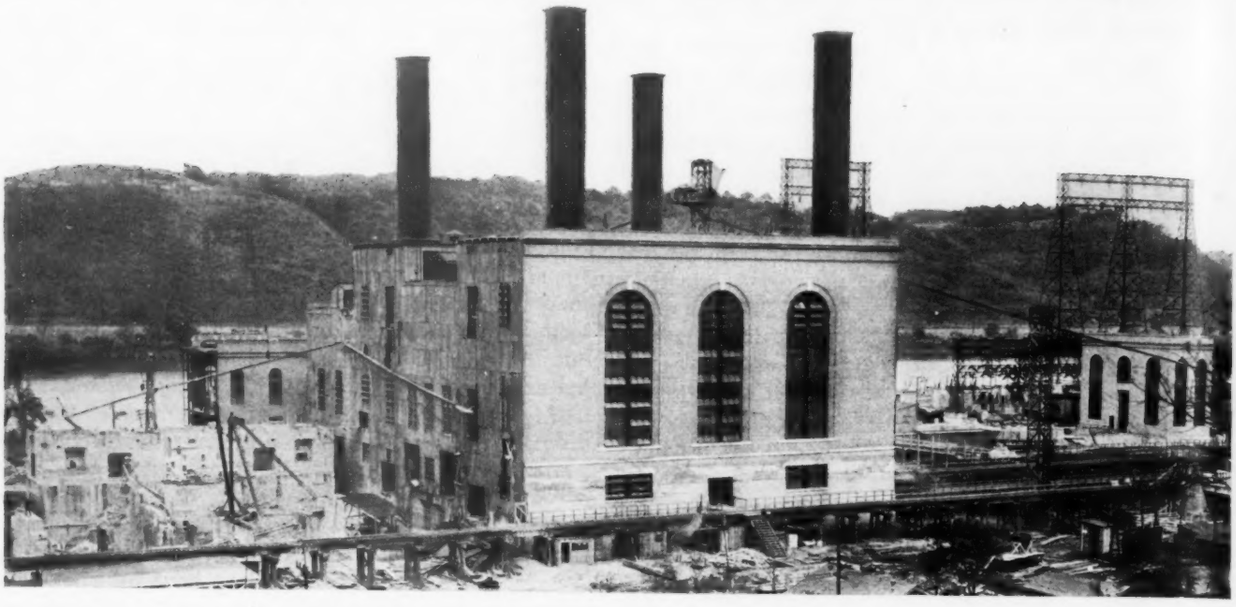
The boiler plant carries out the large proportions of the whole project, for there are but four boiler units for each turbo-generator, carrying 250 lb. pressure and furnished with superheat to 250 deg. Fahr. Each pair of turbines discharges into a single condenser pit, with the Ohio River for source of supply. Condensation involves some serious problems inasmuch as the river varies 50 ft. (15.2 m.) between high and low water. Each condenser pit is therefore carried down 74 ft. (22.5 m.) to take care of this extraordinary variation in level. Inasmuch as the boilers are also fitted with economizers, the auxiliaries are in the main motor-driven and are on a somewhat startling scale, requiring 600 hp. in motors for the two hydraulic air pumps and the two hot-well pumps in each condenser pit. The whole conception and execution of the project is on the basis of great output produced with the utmost economy, and it is estimated that from its situation at the mouth of the mine the plant even now releases to the railroads for other service about 4000 cars, thereby freeing locomotives, tracks and terminals. The significance of this figure, considering the dire lack of transportation facilities, is obvious. When the present plant is completed it will be one of the very largest central stations in the world, either steam or hydraulic, and cannot fail to produce important industrial results in its territory.

It is interesting, too, inasmuch as it is owned in common by two companies, the Central Power Company and the West Penn Power Company. It is probably the first case of two independent companies thus operating a joint generating plant, and the idea of physical union has been carried even beyond this so as to include some of the transmission and distribution facilities. The two companies had each considered building a plant, but found that the joint enterprise would cost not much more than half the sum required for the two separately, owing in no small measure to the great cost of the condensing system. Working as a single station there is a better diversity factor and a higher load factor, to say nothing of elimination of no small number of lines for distribution. To conserve the interests of the two companies the perhaps unnecessary precaution was taken of building the plant on each side of a center line, so that its halves could be operated separately if at some future time it should seem desirable, and for simplicity the respective shares in the plant have been leased to an operating company which takes up the fixed charges and bills the component companies only their respective shares of the operating expense.

This has been determined in a rather ingenious way. Each item of the operating expense has been divided into a capacity charge and an output charge as fairly as has proved feasible. Then each company is charged on the basis of maximum demand and of annual consumption according to the weights given respectively to each of these factors. In this way each distributing company buys its power in bulk of the operating subsidiary on a fair division of costs. The arrangement is somewhat unusual but seems exceedingly practical. At all events, through this conjoint effort the beginnings have been made of bulk supply on a basis which brings at last a great possibility to realization. The experience of the last few years has very plainly shown that save under exceptional circumstances an economical steam plant can give hydroelectric stations a hard rub in the matter of cheap production of energy. Great sections of the country can be reached from commensurate hydraulic sources only by very long transmission lines, and if these are to be undertaken the ultimate ends of efficiency would be best served by turning the hydroelectric systems to the service of regions destitute of coal and permitting the latter to meet their own needs and reach out to adjacent territory as has been done in this admirable pioneer system.

The Coming Issues

WITH transportation facilities as congested as they are at present, the placing in operation of a bulk-supply generating station at the mouth of a coal mine is more than welcome, as it releases many coal cars, locomotives, tracks and terminals which would otherwise be required to serve a number of local generating stations. These advantages are particularly noticeable in the case of the Windsor (W. Va.) power plant, described in this issue, as it serves a great industrial district containing many coal mines, clay-products factories and steel mills which would have difficulty in operating isolated plants owing to the scarcity and poor quality of boiler-feed and condensing water available. The electrical features of this plant, including switching, transforming and auxiliary drive arrangements, will be discussed in the next issue of the ELECTRICAL WORLD. Another feature of the Feb. 19 issue will be a particularly complete discussion of the fuel and maintenance savings possible from treating boiler-feed water. Results of numerous investigations are reported, relative advantages of different water-treating methods are outlined, and the amount which can be economically spent for treating apparatus will be calculated for a specific case. In addition to other articles which should be of interest to engineers with electric service companies, consulting firms, industrial plants, etc., there will be an article giving the results of an investigation to determine the effect of frequency and wave form on the performance of mercury-vapor rectifiers.



Bulk-Supply Generating Station at Mouth of Mine

Features of the Windsor (W. Va.) Power Plant Now Being Operated Jointly by Two Companies—Arrangements Which Have Been Made for Dividing Operating Expense

WHEN considered in retrospect, the construction of the Windsor (W. Va.) plant of the American Gas & Electric Company and the West Penn Power Company will probably be looked upon as marking a new epoch in the central-station industry. Far-seeing engineers and central-station executives now view it as a pioneer station; they see it as one of an interconnected group of great plants strategically located to produce large quantities of energy so cheaply that it may be economically transmitted over wide areas to serve one of the greatest industrial districts in the world. It is true that plants have been built at coal mines before; but they have usually been handicapped by the quantity or quality of water available and have not been so convenient to large markets for energy. Before another year lapses the station will rank among the world's largest steam plants. It is the initial step toward carrying into actual practice in a broad way what has proved to be successful on a smaller scale in the Middle West with steam and in the Far West with hydroelectric power.

As a bulk-supply generating station the Windsor plant has an enviable location. Being on the Ohio River, it has an ample and dependable supply of water for condensing purposes. No other place between the Great Lakes and the Ohio River affords such a good and reliable supply. Plenty of good coal (13,500 B.t.u.) is available and easily securable, as a forty-five-year contract is signed with a coal mine adjacent to the station. Being situated at the mouth of the mine, the Windsor plant releases to the railroads of this country about 4000 cars,* the number that would be required were the energy developed by this plant produced locally. The plant operates at the high economy of 18,000 to 19,000 B.t.u. per kilowatt-hour, thereby saving about 3,500,000 tons of coal annually over that which would be required if the energy were produced in small local plants. This plant has the further advantage of serving a territory in which the general run of boiler-feed water gives enough trouble to isolated plants to make central-station service especially desirable to them.

From an electrical point of view the plant is also excellently situated. It lies in what is practically the load center of the eastern Ohio, western Pennsylvania and Wheeling (W. Va.) industrial districts, being within 65 miles of some of the largest industrial centers of this country—Pittsburgh, Youngstown, Wheeling and Canton—with their coal mines, steel mills and clay-products factories. In addition, the station is within one day's ride and two days' freight distance of 60 per cent of the population of the United States. Lying between the Eastern and Central time belts, the station benefits from the diversity in demand which comes from serving loads thrown on systems at different times by reason of the arbitrary shifting of clocks as the meridian is passed.

This station is particularly interesting because it represents the first case where two independent electric service companies have attempted to operate a generating plant jointly. This pooling of facilities has been extended beyond the generating station, however, to include some of the transmission and distribution facilities. The idea has frequently had its advocates, but until this instance no practical solutions have been found for handling the financial problems involved or for making separation possible in case it is desirable to end joint ownership and operation.

Joint ownership was undertaken in this case because both the Central Power Company, a subsidiary of the American Gas & Electric Company, and the West Penn

*Based on number of cars in transit, loaded or returning, time required for loading and unloading, etc.

Power Company had separately considered building their own plants and found it would cost almost twice as much as for one jointly owned plant. This conclusion was reached because very expensive condensing water facilities are necessary owing to the large rise and fall (53 ft.) in the Ohio River. Furthermore, more reserve units and two operating forces would have been required if two independent plants had been built. As it is, a better diversity factor and hence a higher load factor are obtained. The same thing holds true with the distribution of energy. In some places the two companies have consumers in the same territories, which condition would have required duplication of lines if separate systems were employed.

To avoid the objections ordinarily raised to joint ownership the plant has been built on each side of a center line, so that at any time when the companies wish to separate they may take over separate and distinct plants. The financial problems have been simplified by the owners leasing their shares of the plant to an operating company, of which the Central Power Company and the West Penn Power Company each own 50 per cent of the stock at present. As the fixed charges are covered in this way, the operating company will bill the separate companies only for their respective shares of the operating expenses.

The prorating of the operating expenses has been simplified by dividing each item (Table I) into a capacity and an output charge, thereby compensating for the power factor and load factor. The ratio of the capacity charge to the output charge was arbitrarily chosen in each case, the proportion being obvious in most cases. For instance, supervision has to be provided regardless of whether the plant is operating or not, whereas the amount of fuel used is almost entirely dependent on output, a small percentage, of course, being required for banking. The capacity charge is based on the fifteen-minute integrated peak as actually measured.

From the analysis of each operating expense item it was found that a weight of 63 should be given to the maximum demand and 37 to the actual energy consumed. Thus if one company's maximum demand is 10,000 kw. and its annual consumption 25,000,000 kw.-hr., it will pay (10,000 ÷ plant capacity) × 0.63 total operating expense and (25,000,000 ÷ total output) × 0.37 total output expense. Similar arrangements are made for dividing transmission expenses where the lines are jointly used.

The ultimate rating of the station as it is now laid out will be 180,000 kw. in six units. Sixty thousand kilowatts of this rating is now provided in two machines, and two additional units will be completed in 1918. The last two units will probably be installed shortly thereafter. For each turbine there are four boilers with 12,625 sq. ft. (136.0 sq. m.) of surface apiece. Each boiler is equipped with a separate economizer and induced-draft fan set over the boiler. Forced draft is also applied under the underfeed stokers. The boilers are arranged on both sides of a wide firing room. Along the center of this room is a large concrete coal pit into which fuel is delivered directly from the mine. From the pit coal is delivered to individual hoppers in front of each boiler.

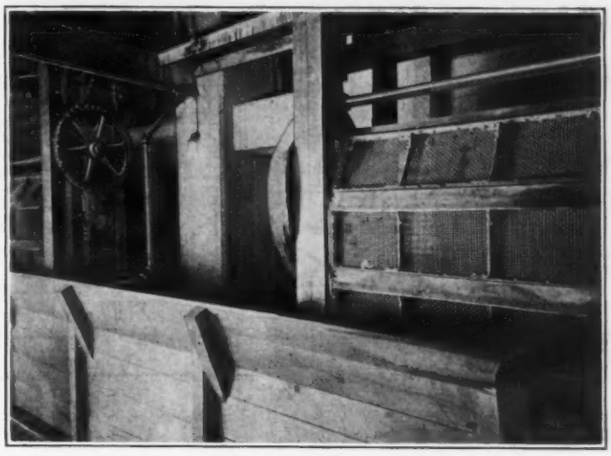


FIG. 2—ROTATING SCREENS STRAIN THE CIRCULATING WATER

In the turbine room the machines are set in a single line with their axes parallel to the firing aisle of the

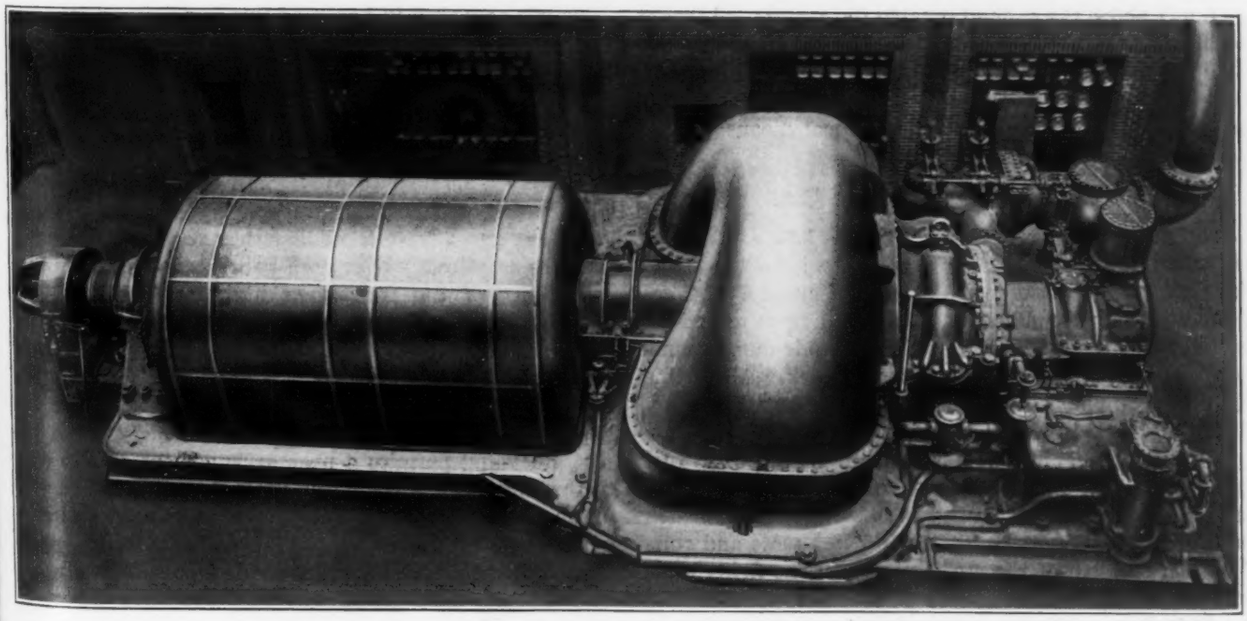
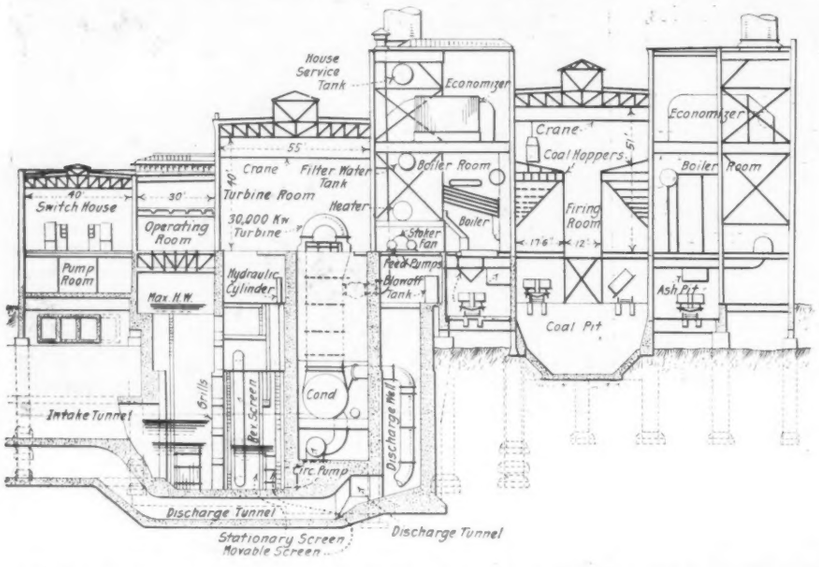


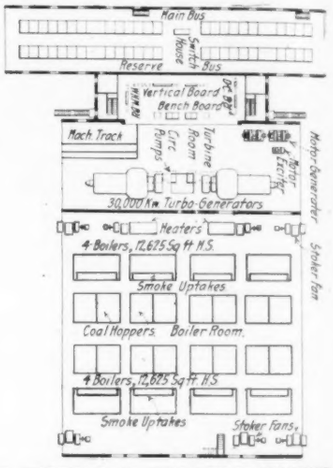
FIG. 1—ONE OF THE 30,000-KVA. TURBO-GENERATORS IN THE WINDSOR PLANT

boiler room. The steam ends of the turbo-generators installed are placed adjacent to each other and directly over a single condenser pit, an arrangement which will be carried out with each pair of units added. This scheme was employed to avoid the expense of two condenser pits, and to facilitate operation of the steam auxiliaries as well as the main units. The walls of the condenser pit serve as a foundation for the main turbines.

A very deep condenser pit was required—74 ft. (22.5 m.) below the main floor level—to permit placing a 3-cu. yd. (2.29-cu. m.) grab bucket operated from an overhead crane. After being weighed it is dropped into the individual hoppers which serve each boiler. This indirect but effective method of handling coal inside the boiler room permits a rather large quantity of fuel to be carried inside the plant without great expense, since it was possible to construct the coal pit of concrete instead of steel. A large coal-storage yard will be provided near the plant in the future.

From the hopper the coal goes by gravity to Westinghouse underfeed stokers with fourteen retorts per boiler. A 100-hp. motor-driven forced-draft fan is provided for each boiler. Stokers of the underfeed





FIGS. 3 AND 4—CROSS-SECTION AND PLAN OF WINDSOR PLANT, SHOWING DEEP CONDENSER PIT, INSIDE COAL-STORAGE FACILITIES AND RELATIVE POSITIONS OF EQUIPMENT

the circulating pumps below the extreme low-water level of the Ohio River, and also to allow placing the condensers low enough for the cost of pumping circulating water to be a minimum at low river stages. The basement floor is just above high-water level and the main floor 18 ft. (5.4 m.) higher. The maximum variation in river level which has been recorded is 50 ft. (15.2 m.).

As this arrangement brings the basement floor 15 ft. (4.6 m.) above the ground outside the station, all tracks running into the station had to be laid on high trestles. While they were costly at the outset, space beneath them will be used for ash dumps for several years to come, thus providing a very economical means of disposing of ashes.

PROVISIONS FOR HANDLING COAL

The coal-handling facilities at the plant are unique in several respects. Coal is secured under a long-term contract from a mine owned by the Richland Coal Company, approximately 2000 ft. (609.6 m.) from the power house. It is hauled into the station in side-dump transfer cars on a standard-gage railroad track. All of this railroad equipment is owned by the central station. Standard-gage track is considered necessary, because in an emergency it will permit the shipment of fuel from other mines without inconvenience. At the plant the transfer cars are dumped into a concrete pit which measures approximately 35 ft. (10.7 m.) wide and runs the entire length of the station beneath the firing aisle in the boiler room. From this pit, which will hold more than 2500 tons (2267.9 t.) of coal, the fuel is lifted in type were chosen for this service on account of the fact that they have proved efficient in burning West Virginia coal and have possibilities of high capacities.

The four boilers which serve each turbine are of the B. & W. cross-drum type. Each boiler has 12,625 sq. ft. (136 sq. m.) of heating surface and supplies steam at 250-lb (17.6 kg.) pressure and 250 deg. superheat. All settings are incased in steel to prevent air leakage. The four boilers which form a unit to serve each turbine are arranged in banks of two facing each other on opposite sides of the firing aisle. Each bank of boilers is connected to a manifold, which in turn is connected to the steam pipe running to the corresponding turbine. Leads from the separate boilers are cross-connected. The drums are placed 26.5 ft. (8.07 m.) above the firing aisle floor to provide an extra large furnace. Diamond soot blowers are installed on each unit.

As the gases leave the boiler they pass through economizers set directly over each boiler. The economizers, which are of the Sturtevant high-pressure type, are arranged in two divisions, eight tubes wide by thirty-six tubes long, giving 8625 sq. ft. (92.8 sq. m.) per economizer. This arrangement, the engineers believe, provides the maximum heat transfer. It also allows the space between the two sections to be utilized for a by-pass duct and permits a neat arrangement of the duct to the double-suction induced-draft fan. Moreover, this arrangement makes the economizer narrower and hence more accessible for repairs and cleaning. Dampers are provided in the uptake and are so arranged that in one position they close off the economizer and in the other they close the by-pass duct.

From each economizer the gases pass through a 60-hp. fan to a smoke flue which connects three boilers to a 13-ft. by 146-ft. (3.9-m. by 44.5-m.) steel stack. Through the combined action of the induced and forced draft fans a practically balanced draft condition is maintained over the fire. The stoker blast equipment is designed to give a pressure equal to 6.5 in. (16.5 cm.) of water. Hand regulation is employed to give proper relation of fuel and air. The ash from the furnaces is dropped into pits, from which it can be dumped into the same transfer cars that are used for bringing coal to the plant.

TABLE I—DIVISION OF OPERATING EXPENSES INTO CAPACITY CHARGE AND OUTPUT CHARGE

	Capacity Charge, per Cent	Output Charge, per Cent
OPERATION		
Labor:		
Superintendence	100	...
Boiler labor	62	38
Turbine labor	100	...
Electrical labor	73	27
Miscellaneous labor	80	20
Total operating labor	83	17
Fuel:		
Fuel for steam	22	78
Supplies:		
Water for steam	...	...
Lubricants	70	30
Steam supplies and expenses	55	45
Power plant supplies and expenses	92	8
Total operating supplies and expenses, excluding fuel	78	22
Total operation	34	66
MAINTENANCE		
Labor and material:		
Repairs to boiler-plant structures	75	25
Repairs to power-plant structures	75	25
Repairs to boiler-plant equipment	56	44
Repairs to prime movers	55	45
Repair to accessory mechanical equipment	56	44
Repairs to generators	56	44
Repairs to accessory electrical equipment	71	29
Total maintenance, labor and material	59	41
Total steam-power production: Labor, fuel supplies and repairs	37	63

As was already mentioned, the river fluctuates as much as 50 ft. between high and low water level; therefore it was necessary to set the condensers in a deep pit measuring 25 ft. 6 in. wide by 91 ft. long and 74 ft. deep (7.8 m. by 27.7 m. by 22.6 m.). The condensing

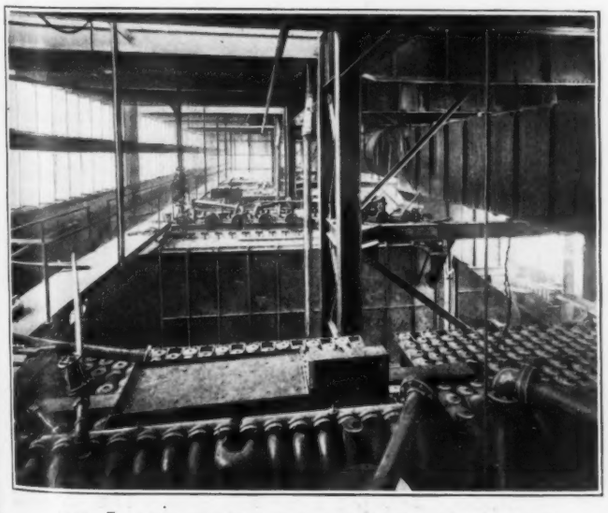


FIG. 5—TWO-SECTION ECONOMIZERS OVER BOILERS

equipment for two 30,000-kw. units is installed in this pit. Each condenser will contain 50,000 sq. ft. (5385 sq. m.) of cooling surface. Making the condenser pits large enough to contain two condensing equipments and providing an opening in the turbine room between the machines has made it possible to handle the condensing machinery into and out of the pit with the 110-ton (99.8-t.) turbine-room crane.

Each condenser is set directly beneath the turbine which it serves and is connected to it by a pipe 13 ft. (3.96 m.) in diameter. An expansion joint with a new type of mercury seal is placed in the exhaust connection just above each condenser. The steel cross members which support the condensers are about 15 ft. (4 m.) above the floor of the condenser well, leaving space in the bottom of the pits for pumps. The vacuum pumps are of the Westinghouse Le Blanc type. On account of the fact that the condenser wells are deep and a large part of the auxiliary machinery is under the condensers electric push-button-operated elevators are employed between the turbine-room floor and the condenser pit for the convenience of the operator.

Water for the entire plant is taken from the Ohio River through a concrete tunnel to an intake crib, which stands beside the condenser well of units No. 1 and No. 2. In the crib the water passes successively through bar-iron grills, traveling screens and stationary screens to the rear chamber of the crib. The station arrangement permits the screens to be handled by the turbine-room crane, which is provided with a 15-ton (13.5-t.) auxiliary hoist. The traveling screens are arranged so that they can be raised or lowered as the river rises and falls.

TABLE II—IMPORTANT DATA* AND LIST OF EQUIPMENT

UNIT BOILER ROOM	
Boilers	Babcock & Wilcox cross-drum water-tube, four per turbine unit.
Heating surface, each, sq. ft.	12,625
Superheater surface, each, sq. ft.	8,625
Heating surface, per kilowatt, sq. ft.	1.65
Working pressure, lb. gage	250
Superheat, deg. Fahr.	250
Stokers, Westinghouse underfeed, retorts per boiler	14
Boiler room coal-pit capacity, tons	2,500
Feed-water heater, rated capacity per square foot boiler heating surface, hp.	0.37
Chimneys (steel unlined), height above boiler floor, ft.	146
Chimneys, diameter, ft.	13
UNIT TURBINE	
30,000 kw., three-phase, 60-cycle, r.p.m., General Electric Co.	
Weight per rated kilowatt capacity, lb.	30.6
Condenser	Westinghouse Electric & Manufacturing Co.
Total tube surface per condenser, sq. ft.	50,000
Tube area per kilowatt turbine capacity per square foot floor space, outside measurements, kw.	140
Circulating pumps, centrifugal, motor-driven; capacity each, gal. per minute	50,000

*These data show what ratios, proportions, velocities, etc., have been used in the design of this station. The capacities are calculated from specification or guarantee figures. Unless otherwise specified, all ratios, both terms of which relate to boilers and kilowatt capacity, are based upon 30,000-kw. unit capacity.

From the screens the water is taken through cast-iron pipes to the circulating pumps, which are set directly under the condenser. Each pump discharges into the bottom of its respective condenser's water box. Similar arrangements will be provided for any other units added. An extra heavy sluicegate operated by a hydraulic cylinder is supplied to control flow of water to each circulating pump.

The discharge from each condenser comes out of the top and goes through a cast-iron pipe to the discharge well. It is returned to the river through a discharge tunnel which lies adjacent to the intake tunnel, but which is brought off at an angle so as to separate the discharge mouth from the intake.

Because the boilers are equipped with economizers and since the large units permit the production of energy at low cost, most of the auxiliaries are motor-

driven. In connection with each condensing equipment there are two hydraulic air pumps driven by 200-hp. motors and two hot-well pumps driven by 100-hp. motors. The hydraulic air pumps are set on a gallery adjacent to the condenser, making a very short suction connection. The hot-well pumps are installed on the floor of the condenser well under the condenser. All of the pumps which are operated in connection with each condensing equipment, including a 50,000-gal. (18,926.6-l.) circulating pump, are motor-driven.

The condensate is pumped through a primary heater in the upper part of the condenser and then up into a feed-water heater of the open type which is set on a platform immediately over the feed pumps. These pumps and one service pump are the only steam-driven auxiliaries in the plant.

Besides the auxiliaries which are attached to each separate unit there are one motor-driven and one steam-driven turbine service pump in the condenser well. These units are connected to a steel service tank under the boiler-room roof. This supplies all service and all make-up water, the latter being run through a settling tank and quartz filter before going to the feed-water heaters. No other water treating equipment is necessary. From the feed pump water is taken to the boilers through a double-feed system, the main feed being arranged to take water through the economizers and the auxiliary feed being arranged to deliver the water to the boilers direct. The water level is controlled by S. C. regulators.

The electrical features of the Windsor plant will be described in a future issue of the ELECTRICAL WORLD.

CONCRETE POLES CARRY 22,000-VOLT POWER LINE

Poles Cast Along the Lines—Cross-Arms Reinforced to Be Independent of Concrete—Erected with Derrick on Truck

In designing an electric pumping system for the 22,000-acre (8903-hectare) irrigation district at Brentwood, Cal., it was decided to take the current required at 22,000 volts. This made it necessary to distribute at this voltage by private line to the seven pumping plants located along a 6-mile (9.7-km.) length of the main canal and requiring in the aggregate approximately 2800 hp. The current was stepped down at each station to an operating voltage of 440.

Reinforced-concrete poles were selected for this transmission line because of their permanency, low maintenance cost and the greater security against line trouble which it was believed they would afford. The poles were designed in accordance with the specifications of the N. E. L. A. report of the committee on overhead-line construction, except that the allowance for ice load was omitted as unnecessary in the territory served.

The poles were considered as concrete beams reinforced symmetrically on four sides. To facilitate the computations and comparisons of costs and strengths for poles of various sizes, curves were drawn based on the A. S. C. E. reinforced-concrete beam formulas for beams reinforced symmetrically on two sides. As a result of the comparative studies it was decided to construct all poles of the same size, but to use two reinforcing systems so that there would be two grades of poles, one light and one heavy. The poles were therefore made 16 in. (40.6 cm.) square at the ground when set 6 ft. (1.8 m.) deep, 41 ft. (12.5 m.) long and 8 in. (20.3 cm.) square at the top. The reinforcing in the heavy pole begins with twelve 1-in. (2.54-cm.) twisted steel bars at the base and in the light-weight pole with eight 1-in. (2.54-cm.) twisted steel bars. The

FIG. 1—MOLDING CONCRETE POLES ALONG RIGHT-OF-WAY

reinforcing decreases toward the top in both poles, but at least four bars extend to the top of the pole in both cases. The heavier pole is designed to withstand a 90-mile (144.8-km.) gale with the wires on one side broken. The lighter pole would probably not fail under these conditions, but would be subjected to much higher stresses.

When these poles were built the price of cement was $2.23 per barrel and that of reinforcing bars 2.3 cents per pound (5.1 cents per kg.). At this rate there went into each pole $7.23 worth of cement and $21.30 worth of reinforcing bars. The total cost of labor, including casting, digging holes and erecting poles, amounted to $30 per pole. The rate on common labor was $2.50 and

FIG. 2—ERECTING CONCRETE POLES WITH SPECIAL DERRICK

for carpenters $3.50 per nine-hour day. The average cost of the 109 poles erected in place was $69.60 each, exclusive of insulators, but inclusive of pine and telephone brackets, and with no allowance for salvage on the derrick built specially to erect the poles or on other tools used.

The average weight of 4 tons per pole made it im-

practicable to cast them in a yard and deliver the finished poles along the line, so the materials used in the concrete were delivered along the line and mixed by hand. Forms were laid on a platform consisting of two 2-in. by 10-in. (5.1-cm. by 25.4-cm.) planks. The vertical sides were held in place at the bottom by cleats and at the top by ties spanning the box. The reinforcement finished as a complete unit was suspended in these forms from the cross ties and the concrete shoveled in and carefully spaded. The cross-arms and buck-arms were molded integral with the pole.

DETAILS OF CONSTRUCTION AND ERECTION

In the cross-arms the reinforcing consists of 2-in. by 2-in. by 3/16-in. (5.1-cm. by 5.1-cm. by 0.5-cm.) steel angles bolted together at the ends and spread apart at the center so the reinforcing bars could be threaded through holes punched in the angles for that purpose. The insulator pins are carried directly by these angles, and thus the conductors are not in danger of falling in

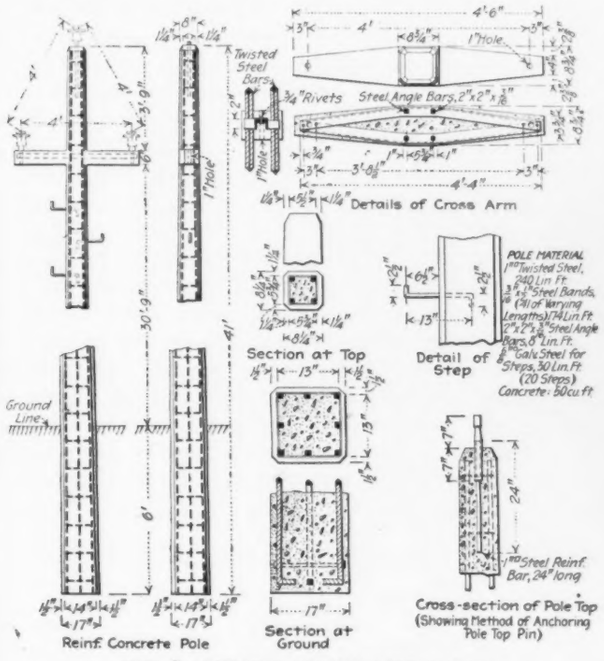

Twisted Steel Bars
¾"Rivets
Steel Angle Bars, 2"x2"x ¼"
1"Hole
Details of Cross Arm
Section at Top
Detail of Step
POLE MATERIAL
1"Twisted Steel, 240 Lin. Ft.
⅜"x1½" Steel Bands, (All of Varying Lengths) 74 Lin. Ft.
2"x2"x¼" Steel Angle Bars, 8' Lin. Ft.
½" Galv. Steel for Steps, 30 Lin. Ft. (20 Steps)
Concrete: 50 cu. ft.
Ground Line
Reinf. Concrete Pole
Section at Ground
Cross-section of Pole Top (Showing Method of Anchoring Pole Top Pin)
½"Steel Reinf. Bar, 24" long

FIG. 3—DETAILS OF CONCRETE POLES

case the concrete is broken from the cross-arms. The spans vary from 250 ft. to 390 ft. (76.2 m. to 118.9 m.). The heavier poles are used at each station and at every fifth pole between, also at road and line crossings where they are set in concrete.

The unusual weight of the concrete poles made it necessary to provide special means of erection. This was accomplished by mounting a double derrick on a dray, equipped with a six-part wire-rope tackle operated by a hand crab on the dray. A 10-in. by 10-in. (25.4-cm. by 25.4-cm.) timber was secured horizontally across the bed of the dray and extended 10 ft. (3.1 m.) beyond. From the end of this timber a four-part manila rope tackle was run to the top of the derrick, thus affording leverage by which the outboard half could be lifted from the ground when it was desired to move the derrick.

After being put in position near one of the holes, two men guided the foot of the second leg as the four-part tackle was gradually eased up, thus locating the legs so that the derrick straddled the hole. A chain sling was placed around the pole just above the center of gravity, the concrete being protected by wooden corner pads. The six-part wire-rope tackle was then hooked on and by means of the hand crab the pole was up-ended and dropped into the hole.

The poles were designed and built and the system was installed for the East Contra Costa Irrigation Company by Augustus Kempkey, consulting engineer, San Francisco, by whom the foregoing information was supplied. The contract for the construction was carried out by Balfour, Guthrie & Company.

WHITE WAY LIGHTING BEGUN IN NEW ORLEANS

First Installment of 20 Miles of System Under Contract with New Orleans Railway & Light Company Is Started

The first installment of 20 miles (32.18 km.) of white way lighting provided for in the city contract signed recently with the New Orleans Railway & Light Company has been completed on Napoleon Avenue. It consists of ornamental metal standards mounting 200-cp. series tungsten lamps in round white globes, in double

NEW ORLEANS "WHITE WAY" LIGHTING IS BEGUN

rows spaced about six units to the block, providing very even distribution of light.

This system when completed will embrace all the principal streets of the city. In all 1500 single-light standards equipped with 200-cp. series incandescent lamps will be installed. At the same time the present arc lamps in other parts of the city, not to be equipped with the ornamental standards, will be replaced with high-power magnetite lamps which will practically treble the illumination afforded by the present system. The result will be a complete reorganization of the lighting of the entire city with a great improvement of the standard of brilliance and efficiency.

If Your Paper Is Late

If your copy of the ELECTRICAL WORLD is late in reaching you, please wait a day or so before writing us that it has been lost. Unparalleled congestion of the mails has caused delays in delivery of all mail matter.

Better Handling of Coal Problem Needed

Stimulus to Production and Methodical Co-ordination of Mining and Transportation Activities Are Essential to Meet the Enormous Fuel Requirements of the Present Year

IT IS characteristic of the energy and resourcefulness of the men controlling electric utilities that they are studying the subject of fuel supply and cost from every angle. They are going directly to the sources of supply, directly to the avenues of transportation. They are looking critically into methods of distribution, are analyzing details of cost.

Their investigation has been directed so carefully into every nook and corner of the coal situation that they may with modesty claim to be authorities equal to any other consumers, equal to many producers and carriers, equal even to the government officials who are now rigidly supervising fuel production, transportation and distribution. Although offering frequent suggestions, although participating actively in movements looking to the correction of past mistakes, they have very generally accepted and made the best of conditions imposed by the fact of war and strict governmental control.

Consumers Become Producers Also

From the position of mere consumers of coal many of these properties have turned to be producers and, in part, the transportation or equipment agencies for their own supply. Collectively, therefore, the electrical industry represents every stage of the coal problem from unmined seams in the ground to grate.

It is from the background thus obtained that the industry, fighting to secure the adequate supply of fuel which alone will keep the steam stations in operation, fighting to secure it at a cost which can be met without financial disaster, presents its claims for better national (whether under government or private control) policies on the vital questions involved. These questions were not met and answered adequately in 1917, nor is the record of 1918 so far any more promising.

Such being the regrettable condition, the electrical industry believes that large statesmanship is necessary, that the co-operation of labor is required, that better co-ordination of production, transportation and distribution facilities is a vital essential in the tremendous-scale improvement which alone will assure adequate supply at fair cost. In the opinion of the industry, a reconsideration of these elements is all that will give comfortable conditions throughout 1918 and in the already dreaded winter of 1918-19.

Reconsideration of the methods adopted in handling these different elements will give an opportunity for new decisions. New decisions can be made in the light of the mistakes in the old decisions, with a longer outlook into the future than it is felt controlled the policies of last year. Admitting frankly that mistakes have been made, there is still room to build new policies for the future and to eliminate the errors of the past. To admit that no mistakes have been made would subject the nation to the risk of the same policies which tangoed it carelessly along in 1917 to the almost fatal consequences of the last few weeks.

In handling the coal-producing industry the government had to face all of the great problems and all of the little details that were certain to exist in an industry loosely organized, many of whose units were unscientifically directed and were deficient in knowledge of fundamental business and commercial practices. It faced an aggregation of unrelated units, large and small intermingled, with little if any uniformity of action, where true cost accounting was not generally in force. It confronted an untrained army of producers where price had run exorbitantly rampant. It found production highly stimulated by abnormally heavy demands from every center of consumption. On top of these conditions, entering them as a bomb might fall into an intensified war-industry factory, there came price fixing, widely advertised differences of opinion between Cabinet officers, advice to consumers not to pay the prevailing market figures but to hold off. And government legislation and ukase followed; prices were fixed only to be advanced when their inadequacy was proved. In short, the conditions which developed rapidly in the production end of the problem were complete demoralization. Producers did not know "where they were at."

The All-Important Transportation Problem

On the monumental issue of transportation the government had before it a condition made up of different factors but all pointing to the entire breakdown of facilities which was so sharp an outstanding feature of the internal situation in 1917. Railroads were years behind their normal construction programs in cars and locomotives, trackage and terminal capacity. Their rates were inadequate. They were not even properly equipped to handle normal business, let alone normal business plus war requirements. They had neither the facilities nor the credit for buying the facilities. In brief, they were helpless to move coal and other traffic with the sure expedition which war demanded.

Both of these factors—production and transportation—together with the collateral one of distribution, the government now has entirely in its hands through the

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THE largest and best-managed electric light and power stations that are burning coal are using it with the greatest economy known in engineering practice. Considering the fluctuating demand for energy, it is not to be expected that by any changes of apparatus they can make any further important saving of coal. The smaller stations and those that are not up to date in their equipment and methods of management can make a great saving of coal by acquainting themselves with what is being done in the best plants and by copying them as far as possible.—*United States Fuel Administration in the* ELECTRICAL WORLD, *Jan.* 5, 1918.

Fuel Administrator and his representatives in all sections and the Director General of Railroads. All power is in the government, but the events of the times show clearly that power alone is not enough to bring cheery brightness out of the gloom of coal supply conditions. Optimism alone will not do it. Clear-sighted wisdom is necessary, not alone in the high seats at Washington, but also throughout the country wherever co-operation can be given. Orders can be issued at Washington, but much more than that is required in a democracy even in time of war. Large planning, foresight, broad vision, plain justice to worker and capital are required in order that the unaccustomed regulations may yield fruit.

MISGIVINGS OVER GOVERNMENT CONTROL OF MINES

Not without many misgivings has the electrical industry seen the sweep of government control over coal mines. There are differences of opinion in the electrical industry concerning the benefits or detriment of such control. In part, they are based on ideas of policy, in part they are based on intimate contact with coal-producing areas and on observation of conditions therein. Generally the electric central stations reached in the ELECTRICAL WORLD canvass merely accept the fact of government control without comment and base their remarks on the condition thus imposed on them. In other cases there is sharp criticism of the effect of government control, as the following expressions show:

I have never heard of the government taking any co-operative steps that had any value to the consumer of our type. In fact, if the government would step down and would let the coal people take care of themselves, I am sure that they would be quite capable of handling it, but the government is not. In my judgment the same thing applies to transportation. From my limited experience with the government in this connection, I think it is 90 per cent responsible for this coal entanglement that we are all in, and I know it is directly responsible for reduction in output in some coal fields by many hundred thousands of tons.

In our judgment the government has taken a very unwise step. It has put in new men to handle the coal proposition, crowding out men who have spent their lives in coal operation. I do not think there is any difficulty in producing all the coal, and more coal, than can possibly be handled by the transportation agencies. Many of the railroads are up against it seriously owing to crippled condition of engines and bad condition of crews. Labor at this time is something never before known. Our laborers are not interested in their work; they only think of the mighty dollar and are afraid they are not getting their share. I believe if assistance could be had from Western roads in rolling stock, especially engines, the coal mines would be able to supply all the requirements made upon them. I also believe, as stated, that these matters should be put in the hands of men who have spent their lives in the industry and know quality and conditions of coal.

The series of articles which is now completed was prepared in the hope that it would result in constructive policies to better the coal-supply conditions. It has presented the point of view of many companies, enormous consumers of coal, and has covered generally all phases of the subject. As bearing particularly on the vital mining and producing features the comment of one company is illuminating. Its constructive suggestions are the result of long-continued observation of coal conditions at short range and of experiences which have been particularly trying during the last winter. Like many other companies, this property has partially met the increased coal cost by a fuel differential added to power rates. This differential was intended to cover the increased cost of fuel and would do so if the fuel were of normal value and quality. It, however, applies at the best to only about one-half of the output, and therefore increased cost of coal has caused a very considerable decrease in the net earnings of the company. The general manager says:

To obtain relief I believe that government conscription of labor will be required. This is especially true of the coal mines. The wages now paid to the miners are the highest in the history of the country. The miner will work until he acquires about a certain weekly wage. In other words, the more you pay him the less time he will work. If he earns sufficient money for his food, his rent, what little clothing he requires and enough beer to last him through the idle time, he quits. As a consequence, the higher the wages the less the production. The coal producer is largely unable to improve conditions without material support and protection from interruptions, annoyances and losses due to labor disturbances.

The transportation agencies can help and could better themselves in various ways, as by the pooling of coal, so that instead of one mine furnishing one particular customer or more, etc., necessitating gathering a few cars from this mine and a few cars from that mine, taking them to classification yards, and there sorting them into trains in accordance with the destination, the coal can be taken directly from the mines to users without entering the classification yards. This would necessitate, of course, a sort of coal-clearing house and would mix qualities up for the time being, but it is also equally certain that classification yards now have standing in them many cars filled with coal awaiting classification and freight movement.

I believe that every classification yard and many sidings in their yards all through the great coal district and between that district and the lakes will, on investigation today, be found filled with coal cars awaiting movement.

Part of the trouble the railroads are to blame for; part the miners are to blame for; part the manufacturers and utilities are to blame for. To illustrate—suppose that a mine and a utility were located at point "A" or reasonably contiguous to point "A" and that a mine or utility were located at point "B" or reasonably contiguous to point "B," with a distance between point "A" and point "B" of one hundred or more miles; does not it look foolish for the coal from point "A" to be used by the manufacturer or utility at point "B" and vice versa? Yet that is practically just what is happening—not in one case but in hundreds.

Standing near the tracks in any one of the large coal-producing districts, you will see heavy freight loads of coal pass from time to time, some going in one direction—some in the other. Why is this cross movement necessary to such an extent? Of course, the answer is that part of the movement has come about by the preference of a certain manufacturer for certain coal; part has come about by judicious railway business handling to obtain traffic; part perhaps from various causes. It is a fact, however, that exists.

ANY one who has had the responsibility of having 140 to 150 carloads of coal for use at the generating stations every morning during the past three or four weeks realizes the coal situation. My conclusion is that in Illinois, at least, if our railroads had been strong, if their terminals had been developed as they should have been for the size of their communities, if they had had the cars and the motive power, we would not have been brought to these five fuelless days.—*J. F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, in an address before the Indiana Engineering Society, Indianapolis, on Jan. 25, touched on railroad unpreparedness.*

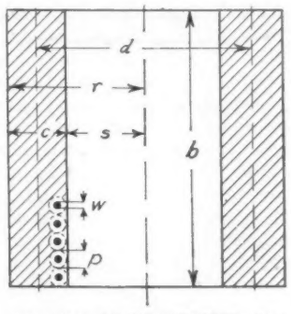
Self-Inductance of Long Reactance Coils

Development of Practical Engineering Formula for Computing This Value, with Two Examples Which Are Worked Out in Order to Illustrate the Application of the Method

BY H. B. DWIGHT

FOR the calculation of the self-inductance of circular coils used in engineering work three formulas are needed to cover the range. These are, first, a formula for long coils, in which the length b (Fig. 1) is greater than the mean diameter d; second, a formula for short coils, in which b is less than d but greater than the thickness c; and, third, one for flat coils, in which b is less than c. In this article an engineering formula (4) for long, thick coils is described, and other formulas for long coils are presented which may be useful for special calculations but which are probably not required for engineering work. Engineering formulas for short and flat coils will be given in a future article.

As indicated below, all the dimensions of a coil should be measured to the pitch lines of the conductors. Thus the length of the coil should be taken as the number of conductors per layer multiplied by the pitch of



SECTION OF REACTANCE COIL

the conductors. The exact dimensions over the copper are slightly too small and should never be used.

In order to obtain an expression for the self-inductance of a thick cylindrical coil, it is first necessary to know the mutual inductance of two coaxial and concentric thin solenoids of equal length. For long solenoids this has been given in a useful form by T. H. Havelock.[1]

By using the form in elliptic integrals given in equation (4) of Havelock's paper in the *Philosophical Magazine*, and by changing to the dimensions shown in Fig. 1, the expression for mutual inductance becomes:

$$M = \frac{\pi^2 d^2 N^2}{b^2}\left[b - \frac{2D}{3\pi d^2}\left\{(D^2+d^2)\,E - (D^2-d^2)\,F\right\} - D\left\{-\frac{1}{8}\,\frac{D}{b} + \frac{1}{128}\left(1+\frac{d^2}{D^2}\right)\frac{D^3}{b^3} - \frac{1}{1024}\left(1+3\,\frac{d^2}{D^2}+\frac{d^4}{D^4}\right)\frac{D^5}{b^5} + \frac{5}{2^{15}}\left(1+6\,\frac{d^2}{D^2}+6\,\frac{d^4}{D^4}+\frac{d^6}{D^6}\right)\frac{D^7}{b^7} - \cdots\right\}\right] \quad (1)$$

where d and D are the diameters of the two thin solenoids, where N is the number of turns on each solenoid, and where F and E are complete elliptic integrals of the first and second kinds, to modulus d/D.

The two elliptic integrals can be expanded in terms of the complementary modulus, K', as follows:[2]

$$E = 1 + \frac{1}{2}K'^2\left(\operatorname{logh}\frac{4}{K'} - \frac{1}{1.2}\right) + \frac{1^2 3}{2^2 4}K'^4\left(\operatorname{logh}\frac{4}{K'} - \frac{2}{1.2} - \frac{1}{3.4}\right) + \cdots \quad (2)$$

$$F = \operatorname{logh}\frac{4}{K'} + \frac{1^2}{2^2}K'^2\left(\operatorname{logh}\frac{4}{K'} - \frac{2}{1.2}\right) + \frac{1^2 3^2}{2^2 4^2}K'^4\left(\operatorname{logh}\frac{4}{K'} - \frac{2}{1.2} - \frac{2}{3.4}\right) + \cdots \quad (3)$$

where $K' = \sqrt{1-K^2} = \sqrt{1-\dfrac{d^2}{D^2}}$.

The expression for mutual inductance can now be integrated twice over the section of the thick coil indicated in Fig. 1, and the following engineering formula for the self-inductance of a long thick coil is obtained:

$$L, \text{ in henries}, = \frac{\pi^2 d^2 N^2}{0.3937 \times 10^9 l}\left[1 - \frac{2}{3}\,\frac{c}{d} + \frac{1}{3}\,\frac{c^2}{d^2} - \frac{4d}{3\pi b}\left\{1 - \frac{1}{4}\,\frac{c^2}{d^2}\operatorname{logh}\frac{4d}{c} + \frac{23}{48}\,\frac{c^2}{d^2}\right\} + \left(\frac{1}{8}+\frac{1}{12}\,\frac{c^2}{d^2}\right)\frac{d^2}{b^2} - \left(\frac{1}{64}+\frac{7}{192}\,\frac{c^2}{d^2}\right)\frac{d^4}{b^4} + \left(\frac{5}{1024}+\frac{17}{768}\,\frac{c^2}{d^2}\right)\frac{d^6}{b^6} - 0.00214\,\frac{d^8}{b^8} + 0.00112\,\frac{d^{10}}{b^{10}} - 0.00066\,\frac{d^{12}}{b^{12}} + \cdots + \frac{2b}{\pi q d N}\left(\operatorname{logh}\frac{p}{w} + 0.14\right)\right] \quad (4)$$

In this formula N is the number of turns of effective conductor in the coil, q is the number of wires or cables in parallel, and the dimensions are in inches. If the dimensions are in centimeters, the factor 0.3937 should be omitted. (Note that logh m = the hyperbolic or natural logarithm of $m = 2.3026 \log_{10} m$.)

It is assumed that the coil is wound with round wire or cable. For square wire the constant 0.14 in the last term should be omitted. The general term of the series in d/b, omitting the terms in c, is

$$\frac{(-1)^n\,(2n)!\,(2n+2)!}{n!\,(n+1)!\,(n+1)!\,(n+2)!\,2^{2n+2}}\left(\frac{d}{b}\right)^{2n+2}$$

By putting $c = 0$ and omitting the last bracket, formula (4) becomes the same as Havelock's expression for the self-inductance of a thin solenoid.

If the more usual expansions of the elliptic integrals in powers of the modulus k are used, the following formula for the self-inductance of a long thick coil is obtained:

[1] *Philosophical Magazine*, March, 1908, p. 340, equation 25; and *Bulletin of the Bureau of Standards*, Vol. 8, No. 1, 1911, p. 56, equation 38.

[2] *Bulletin* of the Bureau of Standards, Vol. 8, No. 1, by E. B. Rosa and F. W. Grover, p. 8, equation 3.

$$L, \text{ in henries} = \frac{2\pi^2N^2}{0.3937\times10^9bc^2}\left[\frac{1}{3}r^4-\frac{4}{3}rs^3+s^4-\right.$$
$$\frac{1}{b}\left(0.2441272\,r^5-\frac{2}{3}r^3s^2+0.4277559S^5+\frac{1}{10}s^5\log\text{h}\frac{r}{s}\right)+$$
$$\frac{s^4}{b}\left(0.004464\frac{s^2}{r^2}+0.000543\frac{s^4}{r^4}+0.000129\frac{s^6}{r^6}+\ldots\right)+$$
$$\frac{1}{9b^2}(r^3-s^3)^2-\frac{1}{30b^4}(r^3-s^3)(r^5-s^5)+$$
$$\frac{1}{84b^6}(r^5-s^5)(r^7-s^7)+\frac{3}{200b^8}(r^4-s^5)^2-$$
$$\frac{5}{864b^3}(r^3-s^3)(r^9-s^9)-\frac{3}{112b^5}(r^5-s^5)(r^7-s^7)+\ldots+$$
$$\left.\frac{bc^2d}{\pi qN}\left(\log\text{h}\frac{p}{w}+0.14\right)\right] \qquad (5)$$

The general term of the power series in s/r in the above formula is

$$\frac{(2n-1)!\,(2a+1)!}{n!\;n!\;(n+1)!\;(n+2)!\;(2n+5)2^{4n}}\frac{s^{2n}}{r^{2n}}.$$

Formula (5) is especially applicable to very thick coils, even those with the internal diameter equal to zero; but as it is long and not easy to apply to thin coils, it does not seem as generally useful as formula (4), which is probably sufficient for the calculation of long coils in engineering work.

Precise Calculation for Moderately Thick Coils

The following extended form of formula (4) gives a precise method of calculation of the self-inductance of long, moderately thick coils:

$$L, \text{ in henries} = L_s + \Delta L,$$

where L_s is the self-inductance of an infinitely thin coil, or cylindrical current-sheet, of diameter d, and where ΔL is the correction due to the thickness of the coil and the spacing of the conductors. L_s may be calculated by formula (4), omitting the terms in c and the last bracket, or it may be accurately found from Table XXI, *Bulletin* of the Bureau of Standards, Vol. 8, No. 1.

$$\text{Then } \Delta L = \frac{\pi^2d^2N^2}{0.3937\times10^9b}\left[-\frac{2}{3}\frac{c}{d}+\frac{1}{3}\frac{c^3}{d^3}+\frac{4d}{3\pi b}\right.$$
$$\left\{\left(\frac{1}{4}\frac{c^3}{d^3}-\frac{1}{80}\frac{c^4}{d^4}\right)\log\text{h}\frac{4d}{c}-\frac{23}{48}\frac{c^2}{d^2}+\frac{1}{1600}\frac{c^4}{d^4}+\ldots\right\}$$
$$+\frac{1}{8}\frac{d^2}{b^2}\left(\frac{2}{3}\frac{c^3}{d^3}+\frac{1}{9}\frac{c^4}{d^4}\right)-\frac{1}{32}\frac{d^4}{b^4}\left(\frac{7}{6}\frac{c^3}{d^3}+\frac{13}{30}\frac{c^4}{d^4}+\ldots\right)$$
$$+\frac{1}{32}\frac{d^5}{b^5}\left(\frac{17}{24}\frac{c^3}{d^3}+\frac{169}{240}\frac{c^4}{d^4}+\ldots\right)-$$
$$\frac{1}{32}\frac{d^3}{b^3}\left(\frac{775}{1536}\frac{c^3}{d^3}+\frac{2167}{2304}\frac{c^4}{d^4}+\ldots\right)+\ldots+$$
$$\left.\frac{2b}{\pi qdN}\left(\log\text{h}\frac{p}{w}+0.14\right)\right] \qquad (6)$$

If the coil is so thick that the terms in c^4/d^4 in formula (6) are not extremely small, thus indicating that further terms of the series ought not be neglected, then formula (5) should be used instead of (6).

For precise work the constant 0.14 in the last term, which is an average value, should be changed in accordance with Dr. E. B. Rosa's results for various shapes of coils, given in the *Bulletin* of the Bureau of Standards, Vol. 3, 1907, page 37, and Vol. 8, No. 1, 1911, page 141.

The results of formulas (4) and (6) are the same, except for one coefficient, as those of a method published by S. Butterworth,[2] giving three corrections to be added to the current-sheet formula, to obtain the self-inductance of a thick coil. The coefficient in that method which is not in agreement with formula (6) is $-1/9\times2167/80$ (equation 23), which, when changed to the notation of this article, becomes $-1/32\times2167/11{,}520$. The corresponding term of formula (6) is

$$-\frac{1}{32}\times\frac{2167}{2304}\times\frac{c^4}{d^4}\times\frac{d^3}{b^3}.$$

In both methods of calculation this term is derived from the same quantity, namely,

$$-\frac{5}{864b^3}(r^3-s^3)(r^9-s^9)-\frac{3}{112b^5}(r^5-s^5)(r^7-s^7).$$

By putting $r=\frac{1}{2}(d+c)$ and $s=\frac{1}{2}(d-c)$ it is seen that the correct coefficient is $-1/32\times2167/2304$ as in formula (6).

Problem I.—To find the self-inductance of a coil with 1000 turns of round wire in ten layers of 100 turns each. The diameter of the insulated wire is $p=0.1$ cm. and the diameter of the bare wire is $w=0.08$ cm. The mean diameter of the coil is $d=10$ cm., the length is $b=10$ cm., and the thickness is $c=1$ cm. (Example 1, *Bulletin* of the Bureau of Standards, Vol. 4, No. 3, page 374.)

Formula (4), omitting the terms in c and the last bracket, gives the value of L_s, the inductance of a thin coil of diameter $d=10$ cm. Thus

$$L_s=\frac{\pi^2\times10\times N^2}{10^9}[1-0.4244+0.1250-0.0156$$
$$+0.0049-0.0021+0.0011-0.0007]=\frac{\pi^2N^2}{10^8}\times0.6882.$$

The remaining terms of formula (4) are

$$\frac{\pi^2N^2}{10^8}[-0.0666+0.0033+0.0039-0.0020+0.0008$$
$$-0.0003+0.0002+0.0002]=-\frac{\pi^2N^2}{10^8}\times0.0605.$$

$$\text{Thus } L=\frac{\pi^2}{100}\times0.6277=0.06194 \text{ henry.}$$

This is less than one-fifth of 1 per cent different from the value given in the bulletin referred to above, which is 0.061865 henry. The self-inductance of the same coil, as calculated by formula (5), is $L=0.06188$ henry. It is not necessary to separate the terms for L_s, as above, but it is often convenient.

Problem II.—To find the self-inductance of a coil of mean diameter $d=50$ in. (127 cm.), wound with ten layers of cable, seventy-five turns per layer, two cables in parallel. The diameter of the cable is $w=0.5$ in. (1.27 cm.), and the distance from center to center of cable is $p=1$ in. (2.54 cm.). Therefore $b=75$ in. (190.5 cm.), $c=10$ in. (25.4 cm.), $q=2$ and $N=375$. As in Problem I,

$$L_s=\frac{\pi^2\times50^2\times375^2}{0.3937\times10^9\times75}[1-0.2829+0.0555-0.0031$$
$$+0.0004-0.0001]=\frac{\pi^2\times50^2\times375^2}{0.3937\times10^9\times75}\times0.7699.$$

The other terms of formula (4) are

[2] *Proceedings* Physical Society of London, Vol. 27, 1915, p. 371.

$$\frac{\pi^2 \times 50^2 \times 375^2}{0.3937 \times 10^9 \times 75}[-0.1333 + 0.0133 + 0.0085 - 0.0054 + 0.0015 - 0.0003 + 0.0001 + 0.0011].$$

Therefore, $L = \frac{\pi^2 \times 50^2 \times 375^2}{0.3937 \times 10^9 \times 75}[0.7699 - 0.1146]$

$= 0.07700$ henry.

The self-inductance of this coil, as calculated by formula (5) is $L = 0.07699$ henry.

INTERPOLE MILL MOTORS VERSUS NON-INTERPOLE

Severe Tests Show that Interpole Machines Will Stand Abuse Much Better than Motors of Older Type and Are Desirable with "Plugging"

BY W. R. RUNNER
Westinghouse Electric & Manufacturing Company

BY FAR the larger proportion of direct-current motors in steel mills require rapid braking, either by "plugging"—that is, reversing at full speed—or by dynamic braking. The former operation is the more severe of the two, as it will be seen that if a series or heavily compounded motor is reversed when running at high speed the armature emf. adds to the line emf. The effect of this is cumulative, the increasing current causing an increasing armature voltage, the maximum value of the latter depending on the speed and the saturation of the magnetic circuits of the motor. While the peaks are of very short duration, the armature emf. sometimes goes to nearly double normal value and the current to three or more times the full-load value. As these peaks tend to produce flashing at the brushes, tests have been made to determine the effectiveness of the interpole in eliminating the flashing. That the interpole motor is better adapted to this service than the older type of motor was very clearly shown by the results obtained.

The motors tested were all of the totally inclosed mill type, series-wound, and represent standard designs of interpole and non-interpole machines. That the motors of a given rating were very similar in speed, voltage and weight is shown in the following table. Likewise, their performance curves are very similar so that the comparison is made on an equitable basis:

	One-Hour Rating, Hp.	Speed, R.p.m.	Voltage	Weight, Lb.
Interpole	80	480	230	4,550
Non-interpole	75	500	220	4,360
Interpole	40	525	230	2,900
Non-interpole	37½	535	220	3,070

The two motors of a size were coupled together, and the one not being tested was used as a generator for load. This had the additional advantage of operating both motors with the same inertia load, an important point in tests of this type. The scheme of connections is shown in Fig. 1, except that the arrangements by which either motor could be used for test are not shown. The usual type of magnetic control was used, so that the interval the current was off between "run" and "reverse" was essentially the same as in actual practice.

The method of test was as follows: The motor M was started by means of the usual starting resistance (not shown) and run at normal voltage. The generator G was loaded with resistance R, its field being separately excited. When the correct speed had been obtained by varying the load on G, the motor M was reversed by opening switches 1-3 and closing 2-4, the magnitude of the peak being determined by resistance R. By reducing R, the plugging peak was increased until a slight spit was produced at the brushes. This point of maximum allowable peak was determined at

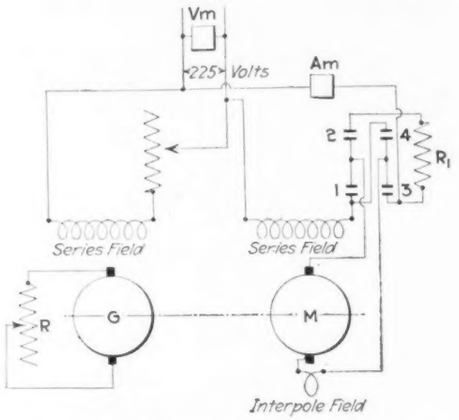


FIG. 1—SIMPLIFIED DIAGRAM OF CONNECTIONS

a number of speeds on all motors, and the results were plotted as shown in Fig. 2.

The curves in Fig. 2 were plotted from the ammeter "kick" readings taken as described in the preceding paragraph. The ammeter used was the usual permanent magnet and moving-coil type, heavily damped. It was known that this meter would not record the actual maximum peak, so to determine the error an oscillograph was used to check the meter at several points on the curve. It was found that at the higher speeds the ammeter and oscillograph readings were reasonably close, but at the lower speeds the ammeter readings were approximately half of the values obtained by the oscillograph. The discrepancy at the lower speeds was probably due to the extremely short time interval required to bring the motor to rest, owing to the large current used and the low speed. At the high speeds the current on "plug" was lower,

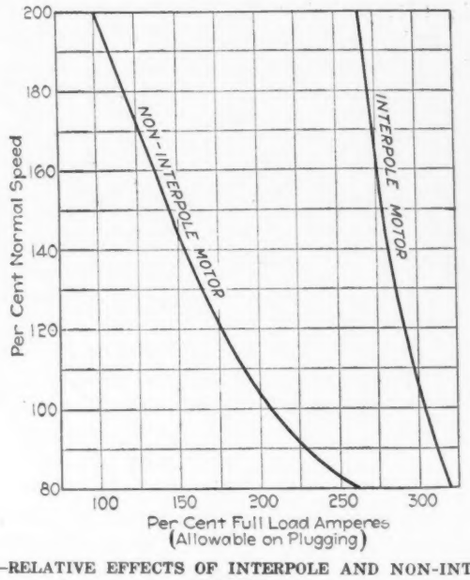
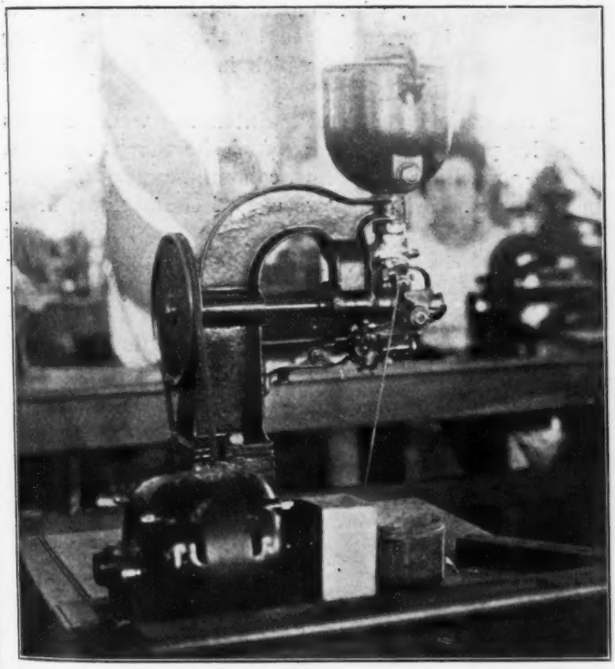


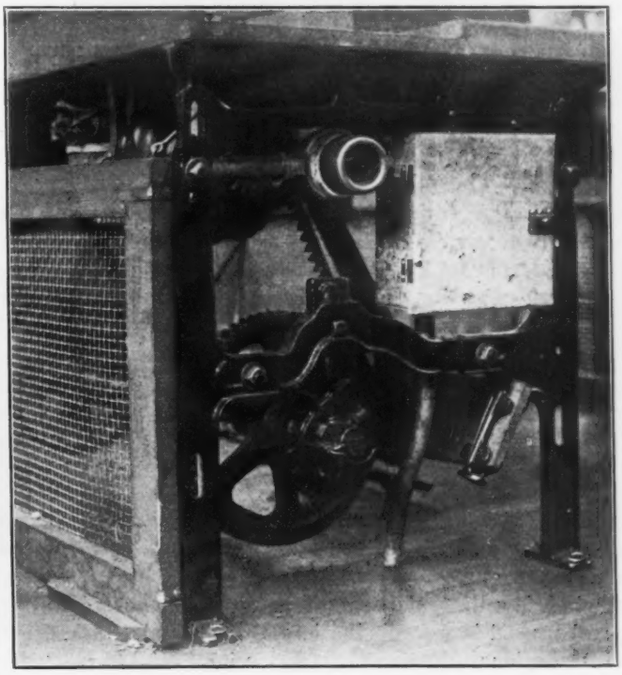
FIG. 2—RELATIVE EFFECTS OF INTERPOLE AND NON-INTERPOLE MOTORS

and the rotative energy high, varying as the square of the speed. This meant a comparatively long time required to reverse, giving the ammeter time to swing to nearly full value. This fact made the test somewhat in favor of the non-interpole machines, as owing to lower plugging currents a longer time to stop was required. As a result the ammeter readings were nearer the actual value of the current commutated than were the readings on the interpole motor.

Referring to Fig. 2, it will be seen that the interpole motor commutated a peak load of 320 per cent normal load at 80 per cent of the full-load speed, and that increasing the speed to 200 per cent of normal decreased the maximum peak only to 270 per cent full-load current. On the other hand, while the non-interpole motor commutated 270 per cent full-load current at 80 per cent speed, it commutated only full-load current at 200 per cent speed.

In addition to the foregoing tests a cycle test was run to determine the effect of plugging on the two types of motors. The same general scheme of connections was used as shown in Fig. 1, except that all operations were controlled by a motor-operated master drum. The cycle of operation was start, run under load, and plug, this being carried out on each motor alternately. This cycle was repeated approximately 7500 times on each test, each cycle requiring about thirty seconds. At the end of this time it was found that the commutator of the interpole motor had acquired a good polish and showed no bad effects from being plugged at 150 per cent speed with a peak of approximately 275 per cent full load. The non-commutating-pole motor, however, did not show up so well as indicated by the curve in Fig. 2, as the commutator began to show signs of pitting, due to plugging peaks of slightly more than full load, the speed and number of cycles being the same as for the other motor. This test was conducted on several different sizes, the results being very much the same in each case, showing that the interpole is extremely desirable in motors which are to withstand severe plugging service.





FIGS. 1 AND 2—CEMENTER DRIVEN BY INDIVIDUAL MOTOR; CHAIN DRIVE, SNAP SWITCH AND FUSE BOX FOR ONE GROUP OF SEWING MACHINES

IMPROVING MOTOR DRIVE IN MAINE SHOE FACTORY

Individual and Group Drives Favored in Different Cases—Arrangements Employed in Repair Shop to Insure Economical Operation

ONE of the best equipped shoe factories in New England from the point of view of the motive-power engineer is the plant of Lunn & Sweet at Auburn, Me. Within two years various features of the motor service have been much improved. Energy is furnished by the Androscoggin Electric Company of Lewiston and Auburn, and the plant is operated by about 175 motors ranging in size from 0.1 hp. to 25 hp. Most of the motors are rated at 3 hp. to 10 hp., the majority being 5-hp. units or under.

An improved motor application in the stitching room is illustrated in Fig. 1. In this section eight "Peerless" fold cementers were formerly belted to a 3-hp. motor which also ran twelve sewing machines. At present four cementers are mounted on a single bench, constituting a productive unit, each machine being directly belted to a 0.1-hp., 110-volt General Electric (Fort Wayne) induction-type motor. The eight cementers require but 0.8 hp. when all are in service, and these motors are more efficiently loaded than under the previous arrangement. A separate snap switch at each operator's position controls the motor, thereby affording maximum ease of control and saving energy.

The bench units mentioned are illuminated by four 25-watt lamps per bench, as indicated in the illustration. Each lamp is mounted in a Holophane metal reflector, the latter being hung by a lamp cable which passes

through the end of a forked wooden arm hinged at the lower end to the counter. Screw eyes in the rod provide a snug attachment for the lead wire and afford sufficient flexibility to enable the arm to be turned through a considerable angle for the convenience of the machine operator. The arms are 30 in. (76.2 cm.) long and were made up at the factory at nominal cost. The

FIG. 3—OLD ARRANGEMENT OF GROUP MACHINE DRIVE

four lamp units on each bench are controlled by a single snap switch from which the units are fed by leads carried in molding, the feed from the floor to the switch being in ¾-in. (19-mm.) iron conduit.

In the stitching room a number of sewing machines were formerly driven in large groups by motors ranging in size from 1.5 hp. to 5 hp. This service has now been subdivided so that in a typical case five sewing machines are grouped on a 1-hp., two-phase, three-wire, 440-volt induction motor. In the older arrangement, which included more machines and larger driving units, control was effected by a four-pole fused switch mounted on a slate base in a 20-in. by 24-in. by 5-in. (50-cm. by 60-cm. by 12.5-cm.) steel box which is carried on walls or posts.

Subdivision has enabled a more compact switch to be utilized, as shown in Fig. 2. The fuses are carried in the fireproof box under the table, but the motor switch is a three-pole snap-type unit of General Electric make, used largely in the latest individual textile-drive installations. Entire satisfaction has resulted from the use of these snap switches on 440-volt power circuits at this factory. The former motor arrangement was less convenient, the motors being mounted in perforated metal boxes on top of the benches, as shown in Fig. 3. Here three 2-hp., 440-volt, two-phase motors operated twenty-six Singer sewing machines, the starting switches and fuses being placed on the back of the bench in each case.

Probably a 5-hp.-motor is the most convenient size used in an ordinary shoe factory, on account of the convenience with which this size may be utilized either singly or in combination drives. Thus, a pair of such motors are belted to a line shaft from which are operated nine rotary shoe pounders. Special care in determining the proper pulley sizes enables this service to be handled between two units, each taking half the load. The two motors in this case are two-phase, four-wire machines and are protected by one fuse in one wire of each phase, or two fuses per motor. A home-made mechanical belt guard arranged with rungs protects the operators in the plant in case a broken belt falls toward the floor, the rungs keeping the belt off the heads of the employees.

REPAIR SHOP FEATURES

In connection with the maintenance of motors at this plant, a compact repair shop is in service adjoining the stitching-room floor. The cabinet is about 10 ft. high, 7 ft. wide and 1 ft. deep (3 m. by 2.1 m. by 0.3 m.). One of the most interesting features is a fuse rack built of three pairs of slotted upright wooden bars of 1.5-in. by ⅜-in. (3.8-cm. by 0.96-cm.) stock. Each pair corresponds to a certain numbered section of the factory and carries the fuse sizes normally used on the motor circuits of that section. In case of a report of interruption the maintainer, who is informed of the factory section involved, seizes the fuses corresponding to that section without any loss of time, and upon arriving at the scene of trouble effects a replacement in minimum time. Even fifteen seconds saved in the restoration of service in a factory where intensive production is the practice counts in these days. Rapid cooling of a burned-out motor, with consequent increased speed of replacement, is accomplished by the use of a Pyrene fire extinguisher, one of which is always kept at the front of the cabinet.

To facilitate layout and maintenance work, a series of roller plans has been prepared showing the location of every machine, shaft line, column, hanger and motor in the plant. Fig. 4 shows one of these plans, drawn to a scale of ⅛ in. to 1 ft. (10.4 mm.-1 m.) and kept in the office of the superintendent of buildings and maintenance, who has charge of all electrical service. Experience shows that a scale of ¼ in. per ft. (20.8 mm.-1 m.) is preferable for future work of this kind. The

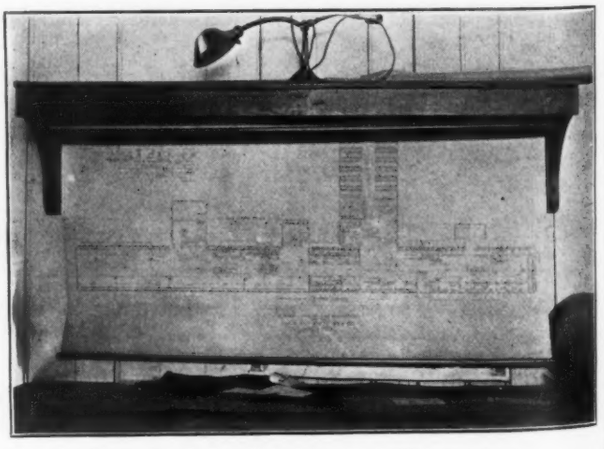


FIG. 4—SCALE DRAWING OF MOTOR LAYOUT

plan shown is about 5 ft. (1.5 m.) long and saves many measurements in the field. The larger scale, however, is more convenient for all around service.

Ernest Bragdon is the superintendent of buildings and maintenance in the plant described, and under his direction the motor applications have for the most part been made.

Synchronizing Stations to Reduce Interruptions

Flexibility of Operation of a 33,000-Volt System Greatly Increased by Installation of Two Synchronizing Stations That Are Some Distance Apart—Use of Electrostatic Synchroscope Reduced Investment Considerably

ENDEAVORING to reduce service interruptions to a minimum and to permit paralleling its stations and shifting loads in the shortest time possible, the Central Illinois Public Service Company of Mattoon, Ill., has installed two three-phase, 33,000-volt outlying synchronizing stations, one at Pana and another at Roodhouse. The design and construction of these installations is of particular interest because they are built primarily in the interest of better and more efficient electric service and because the use of the glower type of synchroscope permitted the engineers to effect a substantial reduction in the necessary investment. The two stations are alike in design and purpose, except that the station at Pana is a two-circuit layout, while the other at Roodhouse is a three-circuit design.

The function of the Pana station is to connect and disconnect the lines between the power house at Mattoon, 42.4 miles (68.2 km.) distant, and Kincaid, 36 miles (57.93 km.) distant. The function of the three-circuit station at Roodhouse is to permit operators to connect together in any combination the lines from the power house at Kincaid, those from the substation at Hull and those to Jerseyville. The system toward Kincaid consists of 250 miles (402.33 km.) of 33,000-volt network fed normally by two power houses. Hull is 50.6 miles (81.5 km.) from Roodhouse, but the system in that direction comprises 252 miles (405.5 km.) of 33,000-volt network, receiving energy from the Keokuk hydroelectric plant normally and from two other generating plants under abnormal conditions. The Kincaid generating plant is about 60.4 miles (90.1 km.) distant. There are four substations but no generating plants on the shorter line to Jerseyville. The relative localities of these points are shown in Fig. 1.

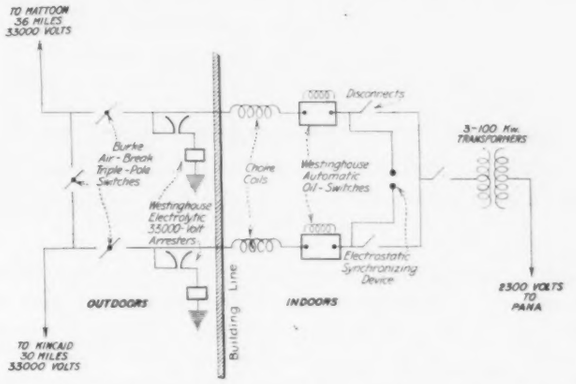


FIG. 2—ONE-LINE DIAGRAM OF CIRCUITS AT THE PANA STATION

Before these synchronizing stations were placed in service it was not customary for the Mattoon and Kincaid plants to operate in parallel. The line was usually open at Pana; consequently when the operators desired to synchronize the two lines it was necessary for one station to drop the part of its load between the two towns, permit the other station to pick up the load, and then synchronize its machines with the completed line at the power house. On account of the fact that the operators and the load dispatcher had to use the long-distance telephone of the Bell system for communication in such cases, it usually required upward of twenty minutes to put the two plants in parallel. Similar difficulty was encountered if one station wanted to shift a part or all of its load to the other. Even if the company had owned its own telephone dispatching lines synchronizing would still have required an interruption. With these new synchronizing stations in operation, however, loads can be shifted and the plants paralleled with great flexibility.

Both of the stations are of the indoor type, not because the equipment itself demands housing, but because of other conditions that entered. At Pana it was necessary to house some mercury-arc rectifiers, so the synchronizing station was placed in the same building. At Roodhouse the equipment was placed indoors because it could occupy a building which had to be put up for an attendant.

The general layout of the Roodhouse station is shown in Fig. 3. All three lines enter through air-break triple-pole switches. Two similar air-break tie switches were also added ahead of these switches for added

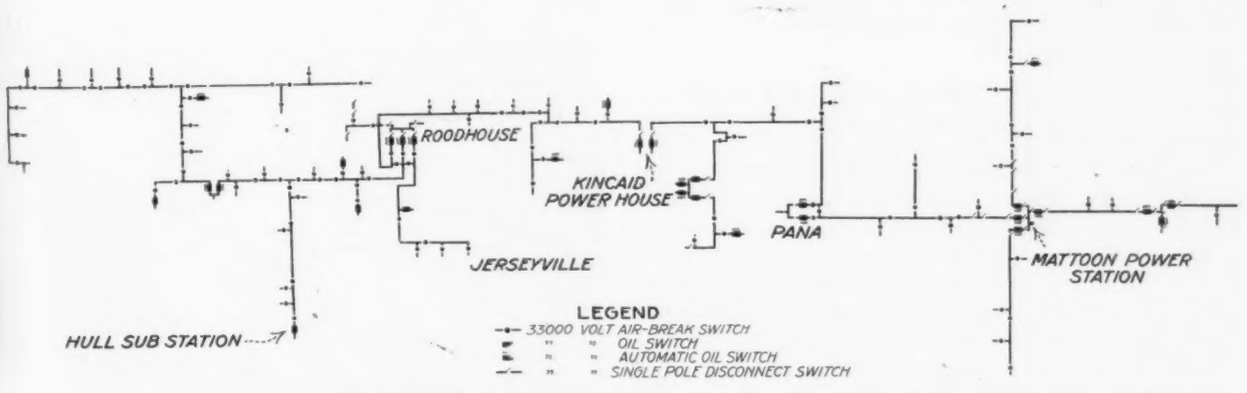


FIG. 1—TRANSMISSION SYSTEM, WITH THE LOCATIONS AT WHICH SYNCHRONIZING STAT IONS ARE INSTALLED

flexibility of operation. The lightning arresters are of the latest sphere-gap electrolytic 33,000-volt type. The breakers are equipped with low-voltage trips to localize trouble and to permit a generating plant to come back on the line quickly after a disturbance. Four sets of

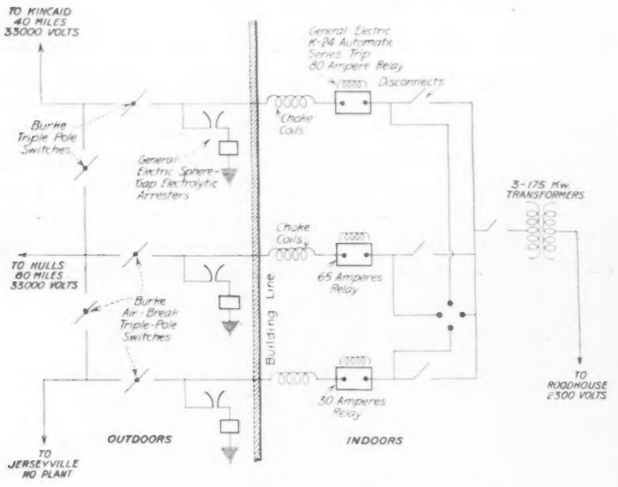


FIG. 3—ONE-LINE DIAGRAM OF CIRCUITS AT THE ROODHOUSE STATION

three single-pole disconnecting switches are installed between the oil switches and the high-tension bus for Roodhouse to permit de-energizing any part of the equipment for repairs. In fact, with the layout as it is, many combinations can be worked out to give continuous service to the three 175-kw. transformers serving Roodhouse and to all other parts of the system and yet leave a section of the station free for repairs or inspection.

It should be observed that three 175-kw., 19,100/2300-volt transformers connected Y-delta, with the neutral of the Y grounded, have been installed. The primary object of this arrangement is to better the service, but it also eliminates to some degree excessive surges and localizes trouble out on the lines more quickly. These transformers are much larger than are required to carry the 200-kw. load at Roodhouse, but the additional rating was thought advisable to take care of breakdowns out on the line which would throw a short circuit through the transformers in one leg of the Y. Therefore, in addition to carrying the load, these units will act as grounding transformers. Since the station will not be heated in the winter, the oil switches are filled with General Electric No. 19 oil. Except for the air-break switches supplied by the Railway Industrial & Engineering Company, all equipment at Roodhouse was supplied by the General Electric Company.

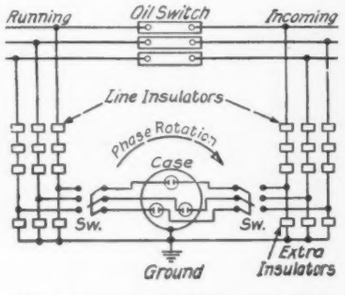


FIG. 4—CONNECTIONS FOR ELECTROSTATIC SYNCHRONISM INDICATOR

The leads to the electrostatic synchroscope are taken from the 33,000-volt line between the oil switches and the "disconnects." The wiring diagram for the synchroscope as it would appear properly connected for synchronizing two circuits is shown in detail in Fig. 4. The synchronizing indicator is known as the glower type. It consists of three electrostatic glowers with special receptacles mounted in a case resembling those

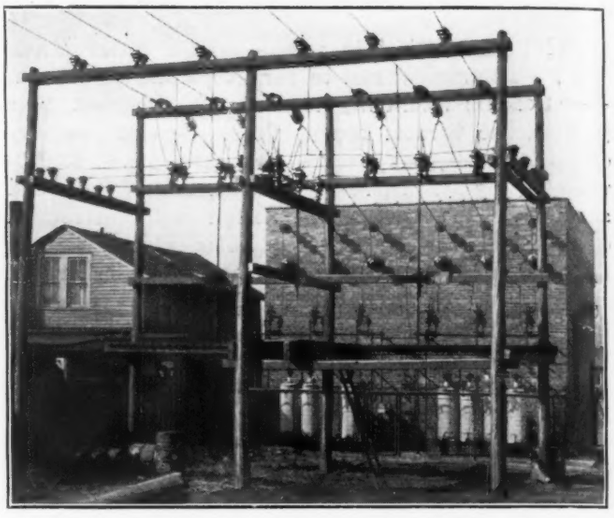


FIG. 5—GENERAL VIEW OF EXTERIOR OF PANA SUBSTATION

used for round-pattern switchboard instruments, two special triple-pole disconnecting switches mounted on a specially treated marble panel with 90-in. (228.6-cm.) pipe supports and braces, a standard disconnecting hook, and insulators for breaking the circuit between the incoming lines and the terminals of the glowers. The device is designed for use on lines having either suspension or strain-type insulators. On lines equipped with petticoat insulators suspension-type insulators would have to be substituted at the point of connection for the synchronism indicator. In all cases one extra insulator would have to be provided for each line wire as shown in the connection on the wiring diagram. The

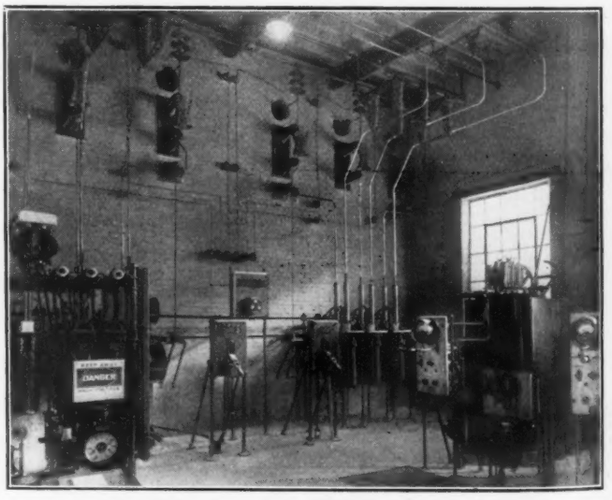


FIG. 6—INTERIOR OF PANA SYNCHRONIZING STATION AND SUBSTATION WITH SYNCHRONISM INDICATOR ON SMALL PANEL BETWEEN OIL-SWITCH PANELS

terminals of one of the glowers are connected to the leads of the same phase of running and incoming lines. These glowers are each connected across dissimilar phases of the remaining leads of the running and incoming lines. When the lines are not in synchronism

the glowers indicate the relative frequency of the lines in the same manner as the usual synchronizing lamps. When the lines are in synchronism the rotating effect disappears, the glower connected to the corresponding lines becomes dark, and the other two show about half brilliancy.

By the use of the electrostatic synchronizing device in this station and the one at Pana it was possible to eliminate investment in instrument transformers and their attendant accessories. These instrument transformers themselves cost about $250 each. Conservatively estimated, therefore, the reduction in investment through the use of the synchroscope was more than $500 for each station. Owing to the fact that certain materials necessary to the manufacture of these synchroscopes are not obtainable, they are at this writing temporarily withdrawn from the market.

The station at Pana is similar in its general design to that at Roodhouse, with the exception, as before mentioned, that it is a two-circuit layout instead of three-circuit. Furthermore, at Pana the use of grounding transformers is not required. The oil switches and lightning arresters in the Pana station were supplied by the Westinghouse Electric & Manufacturing Company.

PLANNING INDUSTRIAL CENTER TO TURN OUT WAR MATERIAL

Electrical Equipment to Be on a Huge Scale—Account of Housing Plans—Fifty-Million-Dollar Appropriation

Housing preparations on a gigantic scale are now being made by the United States government, which not long ago acquired a tract of land near Charleston, W. Va., where industrial works are to be erected covering every possible branch of manufacturing activity for the production of war material. An available appropriation of about $50,000,000 has been made by Congress for this purpose, one of several projects of its kind, and a force of draftsmen, architects, engineers, etc., numbering at least 250 is now engaged designing mills, factories, foundries, machine shops, administration buildings, power plants, dwellings and such other structures as may be useful in the construction, equipment and installation of a city with a population of 10,000.

The property is on the Great Kanawha River, with a water frontage of three miles (4.8 km.) and running back from about three-quarters of a mile to a mile (1.2 km. to 1.6 km.). in depth. The preliminary work of planning and designing the buildings, which will be of all sizes and shapes, is in charge of Graham, Anderson, Probst & White, architects and engineers, 244 Madison Avenue, New York City, who have been commissioned by Secretary McAdoo to put into execution the aims of the Shipping Board. When the ELECTRICAL WORLD called upon the firm for information respecting the electrical equipment and installation of the enterprise, it was found that stage of the work had not yet been entirely finished, although a corps of specialists had been steadily employed for a month past in making plans and estimates. Besides, numerous consultations were held with persons and firms, either professionally or for the supply of material, which may contribute to the speeding up and early completion of the vast war-time industrial undertaking.

For the central station, which will be situated about the middle of the reservation, 2300 three-phase, 60-cycle motors have been decided upon for the distribution of power. The actual motor voltage will be 440. Special electrical equipment will be manufactured for the powder mill, but the size or design has not been as yet determined; and this plan will be followed with other buildings erected for specialized products. Nevertheless, standard types of apparatus and supplies will have the preference when suitable. Construction work is under way, and the specifications for the electrical installation will be taken up and disposed of within a month, probably sooner. A great quantity of motors, with the question of horsepower still in abeyance, will be required. The lighting-plant requirements will call for thousands of tons of cables and wire, great quantities of line material, wiring devices, thousands of insulators and incandescent lamps, projecting floodlamps, conduit, fuses, switchboards, sockets, globes, bowls, shades, not to mention transformers, converters and other apparatus.

So far as could be gathered from the informant of the ELECTRICAL WORLD it is not the intention to advertise for bids but to go into the open market and place contracts for electrical material of all kinds to the best advantage and with firms that can make the best and quickest deliveries. Evidently there will be a minimum of official convention in making purchases whenever the buying starts, and all parts of the country will be called upon to supply the machinery, apparatus and accessories. Doubtless the greater portion of the large equipment will be bought direct from the best known manufacturers, with plants that can handle orders expeditiously; but in the minor supplies manufacturers, jobbers and general distributers having stocks of sufficient size to draw upon will get their share. Being priority orders in every instance, the requisitions will receive immediate attention and prompt shipment will be given to them.

The McKenney & Waterbury Company, Boston, has been awarded a fixture contract for 100 houses at Braintree, Mass., for the War Department, and has recently received similar contracts for thirteen other public or semi-public buildings, most of which are in Massachusetts.

Electric Plants from the French Insurance Companies' Viewpoint

The insurance premiums against fire in electric plants are generally less than those imposed on other plants because of the preventive measures against fire ordinarily taken in building the former. The French insurance companies, now thinking these premiums insufficient, are endeavoring not only to raise the rates but also to limit the risks covered by the policies. A writer in the *Revue Générale de l'Electricité* holds that such limitation would multiply the contests, already too frequent, caused by provisions of this nature, inasmuch as the companies would have an interest in maintaining that fires were caused by electrical accidents not covered by the terms of the contract. He insists that the new tariff shall cover all risks without discrimination, thus simplifying the question of extra premiums and preventing litigation.

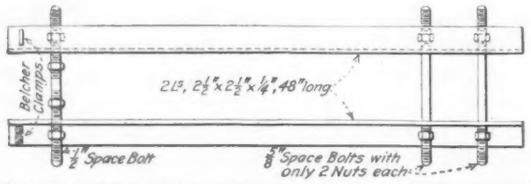
STATION & OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

STURDY TYPE OF BAYONET CONSTRUCTION FOR CORNERS

Method Adopted in Iowa to Eliminate Trouble Occurring from Tendency of Sky Wire to Pull Out of Line at Turns

On its 33,000-volt transmission lines the Iowa Railway & Light Company of Cedar Rapids, Iowa, has adopted the type of bayonet construction shown herewith for use at all corners. With the single-bayonet construction formerly used occasional trouble developed, and this sturdier construction was designed to remedy that condition.



GROUND WIRE IS RUN THROUGH U-BOLT CLAMPS SHOWN AT LEFT END

The outfit consists of two standard 48-in. (121.92-cm.) bayonets, three space bolts, two of which are ⅝-in. (1.58-cm.) bolts and one of which is a ½-in. (1.27-cm.) bolt, and two Belcher clamps. The two larger belts are used to attach the bayonets securely to opposite sides of the pole, while the space bolt above is used to connect the two angle irons together for greater rigidity. The sky wire is run through the U's of the clamps and need not be cut to make the turn. These devices, according to John M. Drabelle, electrical engineer for the company, have proved satisfactory in service.

THE LOCATION OF SWITCHES ON DISTRIBUTION LINES

Accessibility Most Important Point to Consider in Installing Switches and Cut-Outs on High-Voltage Lines

Many companies operating high-voltage distribution lines (6600 volts to 33,000 volts) in agricultural territory make it a practice to install switches at points where branches leave the main line in order to avoid main-line shutdowns in case repairs are required on a branch. These switches may be either fused or non-fused. In addition, fuses are installed at all transformer stations. Where branches run to single transformer stations an economy will result in placing the transformer cut-outs at the point where the branch leaves the main line, thus omitting a duplication of cut-outs at the transformer.

Not only is a saving effected in the installation cost, but maintenance is made easier, since main lines ordinarily run along rural roads while transformer stations are located in adjacent fields. Fuses at branch points are therefore more readily accessible than at transformer stations.

The accessibility of switches is one of the most important points to consider in their installation. A switch not readily available in all weathers is highly undesirable since it may prove inoperative when most needed. On a Western 11,000-volt distribution network a tie line *T* was run to connect to a main line *M* which was in itself a tie between two substations

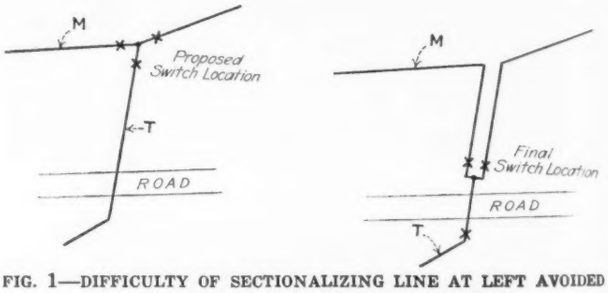


FIG. 1—DIFFICULTY OF SECTIONALIZING LINE AT LEFT AVOIDED BY CHANGING TO ARRANGEMENT AT RIGHT

(Fig. 1). Naturally three air-break line switches were installed to give maximum flexibility.

Investigation of the point of intersection of the two lines demonstrated the fact that a marsh under water in winter intervened between the switch location and the nearest road, one-half mile (8 km.) away. It was therefore decided to loop the main line in the manner shown, placing two of the switches on the adjacent pole on one side of the road and the third on the nearest pole on the other. It is believed that the

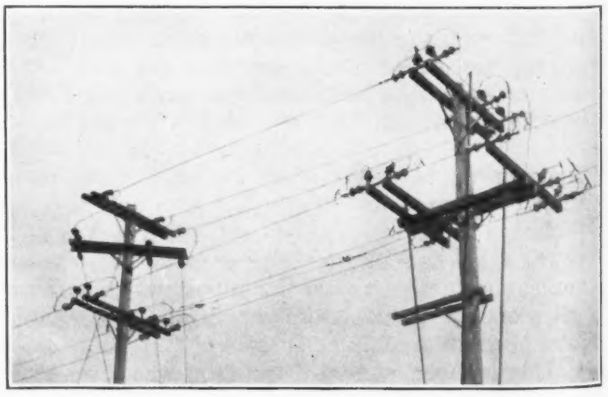


FIG. 2—SPECIAL SWITCH POLES PLACED ON EACH SIDE OF ROAD SHOWN IN FIG. 1

extra half mile of line to make the switches available at all times is a well-justified investment.

In another case location of the three switches at an intersection point at the first pole beyond the intersection in each direction would have placed two of the switches in orchards beyond fences. A special switch pole was installed, and all three switches were mounted on this pole with the operating handles accessible.

Operating handles which may be reached from the ground are great time savers in emergencies and are to be recommended, provided that the handle may be padlocked in either the open or closed position. One Western company which has on its lines several hundred of this type of switch both at transformer stations and branch-line points reports no case in which unauthorized individuals attempted to tamper with a switch. Switch handles should be uniformly installed to be closed when in the up position. A variation in this arrangement which is possible in some types of switches so that the handle is in the up position with the switch open might lead to accidents when switches are operated at night.

Accessibility of switches on distribution lines which are ordinarily not paralleled by company telephone circuits also implies proper location with reference to telephones, particularly those which may be reached at all hours. Often a careful choice of switch locations will save many valuable minutes in the average time taken by a patrolman to reach a switch, open it and report back to headquarters.

PREVENTING EXPLOSIONS IN BOILER FURNACES

Necessity of Special Consideration When Using Low-Grade Fuel—Apparent Causes and Methods of Prevention

BY GILBERT RUTHERFORD

On page 100 in the Jan. 12 issue of the ELECTRICAL WORLD the causes and prevention of explosions in boiler furnaces were discussed, attention being directed to the necessity of increased caution because of the present-day use of low-grade fuels. Additional information is given here on this subject:

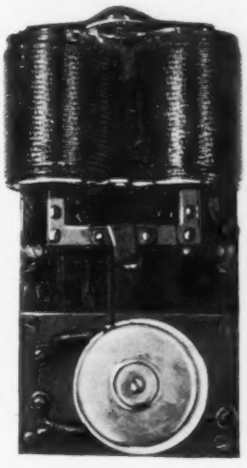
The banked fire may constitute a danger in several ways, a danger that can be largely removed by remembering that it is possible and taking the simple precautions which follow. The cause is evidently that virtually all air supply to a banked fire is shut off so that the distilled gases do not have an opportunity to burn. As a result, if the proper quantity of air is accidentally admitted a violent explosion is liable to occur. To prevent the dangers of an explosion from this cause it is important to shut the furnace and ash-pit dampers sufficiently to prevent air passing through the fuel bed any faster than is required to keep the fire alive; close the flue damper as much as possible without impeding the escape of the gases distilled by the banked fire and allow air to enter the furnace above the fuel bed. By maintaining air circulation above the fuel bed and through the flue damper stagnant explosive mixtures if formed are able to escape. To prevent explosions occurring when opening the bank preparatory to bringing the fire back to active operation the flue damper should be opened some time before closing the air inlet over the fire. Then, after the combustible gases have had accelerated circulation, it is safe to open the fire dampers, and later the firedoor, to start up the fire again.

The crux of the matter of furnace explosions is the control of the air. The air required for complete combustion, which means highest combustion efficiencies, is different from that required for explosion. Maintenance of approximately equal pressures outside and inside of the furnace, which is accomplished easily where the balanced-draft system of automatic control is employed, tends to accomplish this automatically. However, care should always be exercised to safeguard the furnace and the firemen, and the need for this is greater where coal dust and coals of small particles are used.

INEXPENSIVE REMOTE-CONTROL SWITCH FOR STREET LIGHTING

Details of Construction, Operation and Installation Given—Switch Is Used on Multiple Electrolier Lighting and Signs

An inexpensive remote-control switch, series-operated by a pilot circuit, which will be found useful, particularly in controlling multiple electrolier lighting and signs in small communities, may be constructed of a wall-type pull switch in conjunction with a series coil from an old inclosed carbon arc. At present such coils may be purchased for a nominal sum, as many arcs are being superseded by higher efficiency units. The coils and switch are mounted on a wooden base, 4½ in. by 8 in. (11.4 cm. by 20.3 cm.), with the coils uppermost. Leads are brought out to suitable binding posts. The solenoid is attached to the operating cord of the switch by means of a piece of tape which also serves as a buffer between switch case and solenoid.



SWITCH FOR LIGHTING CIRCUITS

One of these switches is installed at each sign or lamp post to be switched and the operating solenoids are connected together in a series circuit by means of a copper or preferably an iron wire line. It will be found that a momentary direct current of 7 amp. to 10 amp. will be sufficient to operate the switch with a quick, positive motion.

The exact direct-current voltage required to be impressed on the circuit to produce this operating impulse will, of course, depend on the number of solenoids in series, their resistances and the characteristics of the connecting series circuit. Ordinarily, a dozen or more switches can be operated from a 125-volt direct-current exciter circuit, and if a 500-volt railway circuit is available a large group can be operated. A field discharge switch is to be preferred for throwing in the circuit.

By the use of two-circuit and three-circuit electrolier switches various combinations of midnight and all-night lights may be switched from the same circuit. In case such switches are used a pilot switch with lamps should be mounted at the operating switch to indicate the position of the switches in the field.

Since the operating current is only momentary, losses in the series circuit may be neglected and a choice of conductor may be made entirely on a basis of mechanical strength, except that the resistance of the series circuit will, of course, limit the total number of switches which may be operated from the available direct-current source.

POWER REQUIREMENTS OF MACHINES IN LARGE SHOPS

Besides Giving Power Requirements, Table Gives Information on the Grouping of Machines and Horsepower of Motors Used

In the accompanying table are given the power requirements and best grouping of machines in a large machine shop that was recently laid out. The shop is divided into fifteen groups, the table giving a description of the driven machines as well as the horsepower of the motor required to drive the apparatus. This table should prove of value to engineers grouping machines for motor drive. The machines have been so arranged that for most jobs raw materials will enter the rear of the shop and pass from group to group, leaving the last group as a finished product.

DATA ON MACHINE GROUPING AND POWER REQUIREMENTS IN A LARGE SHOP

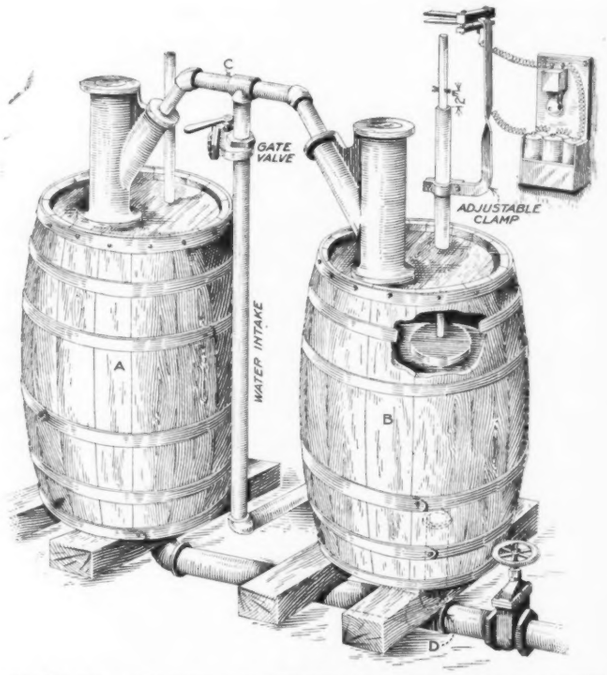
Group No.	Motor		Machines			
	Hp.	No.	Kind	Size	Hp.	Remarks
1	15	31	Shaper	24 in. x 14 in.	2	
		30	Shaper	24 in. x 11 in.	2	
		32	Drill press	½ in.-3 in.	1	
		42	Planer	12 ft. x 4 ft.	15	
		65	Planer	12 ft. x 3 ft. 10 in.	15	
2	5	7	Borer	8 in.	1	
		43	Drill press	⅛ in.-3 in.	1	
		28	Planer	6 ft. x 1 ft.	3	Cylinders
		40	Shaper	15 in. x 10 ft.	2	
		33	Drill press	½ in.-3 in.	2	
3	5	18	Lathe	12 in. x 7 ft.	1	Shaft
		8	Lathe	10 in. x 4 ft.	½	Turret
		37	Emery wheel	8 in.	1	
		71	Surface grinder		1	
		38	Drill press	½ in.-2¼ in.	1	
		63	Sandstone		1	
4	3	13	Lathe	9 in. x 4 ft.	½	Prentiss tool
		10	Lathe	12 in. x 4 ft.	1	Shaft
		69	Grinder (cutter)		1	Garvin
		70	Grinder (cutter)		1	
		46	Drill press	¼ in.-1 in.	½	
5	10	45	Drill press	¼ in.-1 in.	½	
		39	Drill press	in.-1 in.	½	
		57	Auto screw cutter		5	
		58	Auto screw cutter		5	Jones & Lamson
6	5	72	Saw	14 in.	1	Bars and shafts
		73	Saw	14 in.	1	Bars and shafts
		74	Saw	14 in.	1	Bars and shafts
		47	Pipe cutter	3 in.	3	Threads
		48	Pipe cutter	4½ in.	3½	Threads
		66	Punch press		1	
7	5	7	Gear cutter		5	
8	10	2	Lathe	33 in. x 9 ft. 3 in.	7½	Drum boring
		12	Lathe	18 in. x 1 ft.	5	Upright turret
9	10	1	Lathe	36 in. x 14 ft.	10	Large
10	7½	4	Lathe	24 in. x 9 ft.	5	Drum turning
		35	Drill press	¼ in.-1¼ in.	½	
		25	Lathe	8 in. x 1 ft.	½	Screw
		24	Lathe	10 in. x 2 ft.	1	Turret
		14	Lathe	12 in. x 2 ft.	1	Turret
11	10	44	Emery wheel		1	
		3	Lathe	24 in. x 11 ft.	5	Crankshaft
		6	Lathe	18 in. x 6 ft.	2	Winch turning
		5	Lathe	22 in. x 1 ft. 8 in.	3	Gear turret
		67	Wet emery wheel		1	
12	15	29	Slotter	10 in.	5	
		56	Drill press	¼ in.-2 in.	½	
		55	Miller	4 ft. x 1 ft.	10	
		9	Lathe	11 in. x 13 ft.	1	Shaft
		15	Lathe	10 in. x 5 ft.	½	Shaft
		16	Lathe	8 in. x 4 in.	½	Shaft
		20	Lathe	12 in. x 18 in.	½	Shaft
		17	Lathe	13 in. x 7 ft. 6 in.	1	Shaft
		19	Lathe	11 in. x 8 ft.	½	Shaft
		11	Lathe	10 in. x 8 in.	½	Shaft
		36	Miller	4 ft. x 1 ft.	10	Shaft
		41	Crank Press	8 in. 100 tons	1	Shaft
13	10	49	Miller	4 ft. x 1 ft.	10	
		50	Miller	4 ft. x 1 ft.	10	
		51	Drill press	¼ in.-1¼ in.	½	
		52	Grinder	5 in.	1	Emery
		53	Slotter	10 in.	5	
		54	Grinder	5 in.	1	Emery
		21	Lathe	9 in. x 5 ft.	1	Shaft
		22	Lathe	9 in. x 3 ft. 6 in.	1	Shaft
		22	Lathe	8 in. x 4 ft. 6 in.	1	Shaft
		26	Lathe	8 in. x 3 ft.	1	Shaft
		27	Lathe	8 in. x 4 ft. 6 in.	1	Shaft
14	7½	59	Saw	24 in.	5	Circular blocks
		75	Drill press	¼ in. to ½ in.	½	Circular blocks
		50	Saw	24 in.	5	Circular blocks
15	7½	61	Lathe	42 in.	2	Pattern turning
		62	Saw	12 in.	1	Pattern
		63	Planer	15 ft. x 1 ft. 6 in.	3	Patterns
		64	Saw	3 ft.	3	Band

METHOD OF WEIGHING BOILER-FEED WATER

Water Is Weighed in Barrels so Arranged as Automatically to Fill, Ring a Bell When Full and Then Empty

BY T. W. REYNOLDS

Such refinements as duplex-piston meters or Venturi meters, which are generally used in large power plants, are not absolutely necessary for accurately measuring boiler feed. An accurate method is to weigh the water in barrels by the method given here. The apparatus shown is devoid of complications, automatically indicating the filling of each barrel by means of an electrical alarm. A float in a barrel with a piston rising closes a circuit and rings the bell. The piston rises through a 2-in. (5.08-cm.) pipe, the latter serving as a vent to relieve excess pressure tending to burst the barrels.



EQUIPMENT ARRANGED FOR TESTING WATER FOR LARGE BOILERS

The weight of water for a filled barrel is predetermined, and the number of fillings are noted as indicated by the bell. When the barrel is filled the intake valve is closed and the outlet valve opened. When empty the process is repeated as often as may be necessary. Two sets of barrels are necessary for testing large boilers. For small boilers only barrel *B* is required, the tees being plugged at *C* and *D*. With both barrels in use, the incoming water is divided equally to each through Y fittings, and entrance must be made on the side opposite the outlet so as not to disturb the float.

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

INCOME OF 50 PER CENT ON LINE EXTENSION

Pacific Coast Company's Reasons for Requiring a Revenue of This Size Before Starting Construction Operations

The Pacific Power & Light Company, Portland, Ore., before building a line extension, requires an estimated annual revenue from the installation of 50 per cent of the cost of the line. The company arrived at this figure by referring to a report of the Public Service Commission of Washington on the valuation, earnings, etc., of the company made in 1914 and 1915.

The report referred to shows that of every dollar the company has invested 48.7 per cent is in power plants, 15.3 in transmission lines, 5.8 in substations and 28.2 in distribution lines. Besides, the report shows that for every dollar invested gross earnings amounted to 14 cents and net earnings to 6.5 cents. In other words, the net earnings were 6.5 per cent on the investment. With these figures then in mind, the company reasons as follows: Assuming 6.5 per cent as a reasonable rate of return, gross earnings of 14 cents must be had on every dollar of total investment, of which 28.2 cents is in transmission lines. Conversely, then, with every 28.2 cents in transmission lines, gross earnings amount to 14 cents. Therefore, for every dollar in transmission lines gross earnings must amount to 49.6 cents. Therefore, an income of 50 cents on every dollar invested in distribution lines must be demanded. It has been further pointed out by the company that these figures make no allowance for depreciation.

THE SALES DEPARTMENT'S RELATIONS WITH CUSTOMER

How the Activities of Commercial Men Connected with Central Stations May Be Made More Helpful in War Time

Speaking before the American Institute of Electrical Engineers, Chicago Section, Jan. 14, F. A. Coffin, superintendent of power sales for the Milwaukee Electric Railway & Light Company, delivered some particularly pertinent remarks concerning those aspects of economy and conservation which affect the sales departments of central stations. Mr. Coffin said:

An important condition facing all of us is the growing difficulty in financing extensions to meet new customers. We are rapidly approaching a condition where only such new capital expenditures are justified as are directly necessary to the prosecution of the war. It is probable that, in addition to the deterring influence of the high cost of obtaining new money, we shall have regulatory action by federal authorities. All of this vitally affects expenditures for line and service extensions which have hitherto been an inseparable part of the progress of attacking new business. There has been the same radical revision of the rule with respect to line extensions, and it is the case that during these times new customers will be required to finance at least the difference between normal cost and present abnormal costs in supplying them service.

The second aspect of importance is economy in the conduct of the sales department. I do not share in the pessimistic viewpoint that the war leads to a curtailment of the use of electric service. Early this year our company dispensed with all but the nucleus of its sales organization, and it is of interest to note that the increased business which we hope to receive by the end of the year through the usual sales methods has all come to us unsolicited. The high cost of fuel has no doubt made many industrial enterprises more ready to inquire for electric power supply, and a part of the business gained has been secured through the momentum of the past sales efforts; but, even discounting the effect of the fuel shortage, there is still a normal increase in the demand for service.

The third aspect to which I desire to direct attention is the question of character of service. The user of electric energy in America receives more in auxiliary service rendered by the engineering department, the trouble department, the lamp-renewal department, etc., for the rates he pays than the customer in any other country. We have naturally taken great pride in the completeness of the service we furnish, but there is no gainsaying that it imposes a very substantial expense, which is probably not justified in these times. The food administrators are now recommending an extra charge for delivery of parcels from other mercantile institutions, and there is no reason why similar modifications should not be made in our rules with respect to delivery of lamps, appliances, etc., or why the amount of gratuitous assistance given by engineering departments should not be gaged by the necessities of the situation, rather than by a mere endeavor to accommodate the customer.

Finally, and by no means the least important, the duty of the sales department lies in co-operation with the fuel conservation program of the government. Lightless nights perform an admirable function in impressing upon all customers the necessity of conservation, and no doubt the sum total of little economies effected will help the nation save coal; but we should be deceiving ourselves as well as the public if we lost sight of the fact that the actual amount of fuel in the power house saved by this method is indeed very small, being a mere fraction of 1 per cent of the total coal consumed by the central station and an infinitesimal part of the coal used by the entire community. There is much to be done besides enforcing and thoroughly co-operating with the rule with respect to lightless nights. Perhaps the most important economy which can be achieved would be the organization by the Fuel Administrator of a voluntary inspection service for industrial plants charged with making definite practical recommendations on the proper installation of steam-pipe coverings, satisfactory maintenance of boiler settings to avoid air leaks, scale elimination in boilers, care in banking and firing boilers, avoidance of general illumination of unoccupied factory space, possible savings effected by shutting down machinery when not required, etc., and the general elimination wherever possible of the non-condensing plant. In such a work the commercial engineering department would do effective work. It is not necessary for me to point out that such a system by the central station is a labor in the interest of patriotism.

We are naturally not interested in laboring to make the isolated plant more efficient. Our interest in normal times is to shut it down and to sell it service, but the necessities for fuel conservation are so great and pressing and the possibilities in this field are so substantial that no effort should be spared to co-operate to the greatest extent possible.

EXAMPLE OF CO-OPERATIVE READJUSTMENT OF LOADS

Power Customers Come to Central Station's Assistance, Thereby Reducing System Peak and Insuring Full Energy Supply to All

An instance of patriotic co-operation between a central station and its power customers recently came to light in connection with a service investigation bearing upon the coal shortage. The central station in this case purchased the bulk of its energy from a hydroelectric power company, and was asked by the management of the latter to cut out 20,000 kw.-hr. a week of its input from the water-power system. Further to conserve the energy supply it was requested that each Tuesday a "powerless day" be observed, during which no energy would be taken from the water-power company's lines. The central-station manager in this case was exceedingly loath to shut off energy from any of its customers. His system, though a small one, extended through a dozen municipalities, and it was seen that to cut off the supply would be a great hardship locally. Conferences were held with various power users, and one of these agreed to start up a 250-kw. steam plant and run it twenty-four hours a day, feeding energy into the central-station system as required, in addition to the demand of the machine owner. Eight other power customers voluntarily agreed to cut off their service at 4 p. m. Tuesdays, resuming work at 7 p. m. the same day and running as far into the evening as necessary to make up the deficiency in output. By this arrangement the hydroelectric company was relieved of the 20,000 kw.-hr. above mentioned each week and the peak load on the system was reduced, to the great advantage of the general water-supply situation in the territory, all customers continuing to receive full total weekly service.

LIMITATIONS PLACED UPON FREE SERVICES

Gratuitous Repairs and Deliveries Now Being Curtailed as a War-Time Practice by Commonwealth Edison Company

In speaking of the war-time practice of the Commonwealth Edison Company in regard to gratuitous service before a recent meeting of the A. I. E. E., D. W. Roper, superintendent of the street department of the company, said:

In the most prosperous times if there was any trouble with a customer's lamps or motors the company would, on request, send its troubleman to the customer's premises. If the interruption to the lamps was caused by some minor defect in the wiring or in the appliances, or the sockets of plugs or switches, the repair man would, if he could do it in half an hour or so, make the repairs sometimes temporarily, but he would make the repairs so as to enable the customer to get service. He would then advise the customer what to do in the way of making permanent repairs. Nowadays the company makes a minimum charge of 35 cents for sending a repair man to the customer's premises. If the trouble is found on the customer's premises and does not have to do with the company's part of the system, the charge is considered valid. In addition, a further charge is made for any time over the first fifteen minutes which the man spends on the customer's premises. This practice applies also to heating-device calls in apartment buildings.

There formerly was a sort of a perpetual guarantee on cords for electric flatirons. The practice now is to charge the customer for the cost of the repair. The charge is 75 cents for replacing an electric-iron cord. This applies also to other heating devices.

Incandescent lamps for a number of years have been delivered free. The company's rates, of course, require that the lamps shall be furnished free, but they do not require that they shall be delivered. It is probable that within the next few weeks the company will make a charge for the delivery of lamps similar to the charge now made in answering a trouble call. It will, of course, be possible, even under the new arrangement, for the customer to get his lamps free by applying for them at one of the numerous delivery stations in the various parts of the city.

A BONUS AND PENALTY SYSTEM FOR SALESMEN

Profits from Fixture Campaign Contribute Materially to Support of Sales Department, Besides Stimulating Lighting Business

On March 1, 1917, the new-business departments of the subsidiaries of the Cities Service Company inaugurated a campaign for additional commercial and factory lighting, as stated in the ELECTRICAL WORLD for Feb. 2. The number of fixtures sold as a result of this campaign in the communities served by nine subsidiaries was 5600, with a merchandising value of $89,600.

This business has been taken entirely from existing customers, so that no new services were required and the installation expense was held to the minimum.

The salesmen worked on a commission basis with a system of penalties and bonuses under which they received a profit on the sale of fixtures and on the increased consumption from the customer and were penalized for any business taken without increasing the wattage. These commissions were figured as follows: 25 cents per fixture for 75-watt fixtures, 40 cents per fixture for 100-watt fixtures, 50 cents per fixture for 200-watt and 300-watt fixtures, 65 cents per fixture for 500-watt fixtures or larger. In addition to this a bonus was paid of 50 cents per 100-watt increase in load added to any installation. In any case, however, where the salesman sold new units without increasing consumption he was penalized by not receiving any commission whatever on the sale of the fixture.

The profits secured from this compaign have contributed materially to the support of the sales departments in these properties.

FLATIRONS LOANED TO CONSERVE COAL SUPPLY

Pittsfield (Mass.) Central-Station Company Makes Non-Obligatory Proposition to Customers to Extend Over Six-Month Period

The Pittsfield (Mass.) Electric Company, in an effort to help conserve the coal supply, has made a proposition to its customers to loan them until July 15, without charge, electric flatirons which they may use as they see fit, without any obligation. The flatiron offered is one of the latest General Electric models, retailing for $5. The offer states that if at the expiration of the time of the loan the customer wishes to keep the iron the company will sell it to him for $4, payable either in cash or on monthly payments of 50 cents each month until it is paid for. To each customer a return post card has been sent with the announcement.

WHAT IS LEFT FOR THE CENTRAL-STATION SALESMAN?

Opportunity Which Present Conditions Offer for Actively Developing Appliance Load Can Be Made of Great Importance

BY H. V. COFFY
H. M. Byllesby & Company, Chicago, Ill.

The central-station industry, among others, is finding existence difficult and somewhat uncertain. Of course, gross earnings show up well, but the operating costs leave little net profit. An increase in rates is one thing the industry must have if it is to continue good service to its customers and meet legitimate obligations to employed capital.

Some companies have been successful in securing the right to make a war surcharge, and many more will secure some similar form of rate relief for the period of the war. Rates are only one of the central station's problems. The difficulty of securing capital on reasonable terms is another.

There has been some talk of the government giving electricity-producing concerns certain priority rights in the demand for new capital. Unless something of this sort is done the central station is going to be overwhelmed with proffered new power business and absolutely powerless to serve it. Even if the government does provide a means for these vital industries to secure the necessary capital to build extensions and furnish equipment for the growing demands of war necessities, the cost of material, supplies and labor and the difficulty of obtaining them make it problematical whether the condition can be successfully encountered before the end of the war.

While there are many other problems, the two mentioned are enough for the central-station salesman. It means he can no longer seek new light and power business as he has been accustomed to—it means he must go after business from an entirely new angle or get into some other department of the business.

He may not be permitted to seek new power business actively which is to be served from an extension, because the extension requires capital, and capital is not to be had. Or, if he is fortunate enough to be employed by a company which is still able to make reasonable extensions, he may have to use the utmost care and discrimination in selecting his "prospects," with the certain knowledge that it is only a matter of time until he must abandon even these efforts. Many companies do not permit the salesmen to take on new power business even from present customers if it comes on or near the peak, because the capacity of the station is overloaded.

While the central-station salesman faces a serious problem, he also faces a big opportunity—domestic electric appliances.

For years there has been talk of the domestic appliance load filling up the valleys. It has been thought that some time in the future the electric appliance load might represent one of the central station's greatest loads. Manufacturers have preached it and advertised it; central-station companies and central-station salesmen have believed it, but they have conducted their advertising and their campaigns for the most part in a desultory and spasmodic way and have fallen far short of the real possibilities.

Undoubtedly the past year has seen the greatest progress in the development of the uses of electrical appliances of all the years in the history of the industry. This year will see even greater progress, particularly if the central stations get busy and do just a reasonable amount of promotion and sales work.

It is believed that every city in the United States has felt this growth during 1917. There is one city, for example, with a population of 75,000, the electrical dealers of which sold more than 3700 electrical appliances during the first ten months of the year—nearly 100 a week. No special efforts have been made to build up the electrical appliance business in this territory; it is simply natural growth as the result of the housewives recognizing their needs and satisfying them. What would have been the total if really serious efforts had been made to build up this class of business? This particular community has always been a good appliance territory, but it is safe to say that never before in a like period have anywhere near so many appliances been sold. It is doubtful even now if there are more than half a dozen houses in the city which have anything like a full equipment of electric household time and labor savers, and there are probably thousands of homes in this community which do not possess more than one electrical appliance.

Every house on the lines of a central station is a prospect for this kind of business. If the family have an electric flatiron, the company should try to sell them a vacuum cleaner. If they have both of these, sell them a washing machine. If they have this, get out the sewing-machine motor. If in each instance the real time and labor savers are sold, the other electrical conveniences will come naturally, without much sales effort. Every electrical appliance sold at a home makes it just that much easier to sell another one—assuming, of course, that the purchaser gets real service after the purchase is made.

Many central stations in the past have offered time payments on all electrical appliances. All of them ought to do this. Now particularly, when anything which costs more than $5 can be purchased on time, special easy terms on electrical appliances are imperative and should be given to the public continuously.

ECONOMIES IN METER READING AND DELIVERY OF ACCOUNTS

Middle Western Company Materially Reduces Regular Force by Means of Employment of High School Students

The employment of high-school students in addition to the necessary regular force to read meters and distribute bills to customers has been practiced for several months past by the Sandusky (Ohio) Gas & Electric Company. This system, the company states, is not only materially reducing the expense of reading meters and distributing bills, but in addition makes it possible to reduce the regular operating force to a minimum, as it has been found that where all meters are read between the twentieth of one month and the first of the next it is not always possible to keep the entire force busy during the period from the first to the twentieth of the month, when no outside construction work is under way during the winter months.

TECHNICAL THEORY & PRACTICE

Including a Digest of Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Insurance of Electrical Machinery.—C. STUART BUYERS.—Attention is called to the dependence of industrial output on the reliable operation of the motors used. It is suggested that more plants, not having the services of expert electricians or engineers, insure their motors and take advantage of insurance-company inspectors' advice to determine when motors need attention.—London *Electrical Review*, Dec. 28, 1917.

Alternating-Current Automatic Starters for Squirrel-Cage Induction Motors.—W. H. PATTERSON.—An explanation of the operation of an automatic alternating-current starter for squirrel-cage-type induction motors. Some of its applications and limitations are pointed out.—*Power*, Feb. 5, 1918.

Lamps and Lighting

Portable Magneto Lamps in the Teutonic Armies.—A description of several types of such lamps found in ground recovered from the enemy. They are operated by springs actuated by the hand and have obvious advantages over the non-enduring storage-battery pocket lamp. The drawback of weight, however, makes it little likely that they will supersede the other type. The most powerful of the magneto lamps, which has a reserve of energy affording ten minutes' lighting with no movement of the hand, weighs about 1580 grammes, or 3.3 lb.—*L'Industrie Electrique*, Nov. 25, 1917.

Arc Lamps with Two Pairs of Carbons for Networks with Polyphase Currents of Low Frequency.—ANDRÉ BLONDEL.—Description of a very simple arrangement for suppressing the difficulties that result from the employment of many polyphase arcs.—*Revue Générale de l'Electricité*, Dec. 22, 1917.

Electric Lamps in Non-Gaseous Mines.—GEORGE H. DEIKE.—According to the author, fussing with oil and carbide lamps consumes thirty to fifty-five minutes per shift and reduces the loader's output 35 per cent. Insurance earnings on electric lamps will pay about 18 per cent on the money invested in them. Electric lamps cost roughly a half less to maintain than oil or carbide lamps.—*Coal Age*, Feb. 2, 1918.

Generation, Transmission and Distribution

Some Developments in the Electrical Industry During 1917.—JOHN LISTON.—A review of the activities of the electrical industry during the past year. There are, however, many important developments associated with war work that cannot be mentioned for obvious reasons.—*General Electric Review*, January, 1918.

Mechanical Features of Transmission Lines.—A. GRONDA.—The author discusses latticed posts critically, showing they are not always the most economical, and that tubular construction is sometimes preferable; he considers the reactions between conductors and posts, and gives a chart for the calculation of the tension of aerial lines, showing how to employ it to determine the strain put upon the posts when they are unsymmetrically loaded.—*L'Ettrotecnica*, Dec. 15, 1917.

A South American Power House.—Description of the new central station at Tocopilla, Chile, built for the Chile Exploration Company, one of the largest copper-mining concerns in the world. This power house is 3000 m. (approximately 2 miles) above sea level and serves a 110,000-volt transmission line, the highest tension in operation in South America. Its capacity is 60,000 hp., with room for future growth, four Zoelly steam turbines rated at 15,000 hp. each having been installed. Each turbine is directly coupled to a Siemens-Schuckert 10,000-kva., 5000-volt, 50-cycle, 1500-r.p.m. turbo-alternator.—*Boletin de la Asociación de Electro-Técnicos* (Buenos Aires), October and November, 1917.

Central Stations and Fuel Economy.—E. LEHOUX.—The author maintains that, without affecting their output, many central stations can reduce their consumption of coal by from 10 to 15 per cent by the application of scientific principles to the construction and operation of mechanical and electrical equipment. These principles are based on the transformation of calorific energy into electrical energy at the lowest cost, whether the transformation is wrought by means of gas engines or by steam engines or turbines. Gas engines are economical only in central stations having a high and constant load factor or where surplus production can be utilized for storage batteries. Steam-operated power houses fall into two classes, those supplementing hydroelectric installations and those operating alone or in connection with other steam stations. The first class, operating intermittently and with a variable load, consume coal at a much greater proportionate rate than the second class, and it is in them that the best opportunities for economy occur. In plants built from 1900 to 1908, with modern equipment and generating units rated at from 1000 kw. to 1500 kw., a kilowatt-hour was produced for every 15,000 calories, or for 2 kg. (4.4 lb.) of coal having a calorific power of 7500 calories per kilogram. Since then in very high-powered plants, with turbo units rated at from 10,000 kw. to 20,000 kw., the record has been reduced to 8000 calories for a kilowatt-hour; that is to 1.07 kg. (2.35 lb.). The author inquires how much nearer the theoretical value 1 kw.-hr. = 863 calories, or 0.115 kg. (0.253 lb.) of coal, it is possible to come. His estimate of 10 or 15 per cent improvement is based on a detailed study of the entire cycle of transformation. To bring it about he would install a complete outfit of meters and registers for every step in the process of creating heat and converting it to electric energy, electrifying these instruments and bringing those for each boiler together upon a board in a convenient position where they would be under the constant supervision of an experienced operator. In addition, equalization of central-station load and im-

provement of the load factor of the network of distribution are of great importance. Finally, constructors should bend their energies to the perfection of the gasogen, as a means of ameliorating furnace output, and to the study of the still experimental gas turbine. —*Revue Générale de l'Electricité*, Dec. 15, 1917.

Peat and the Electric Industry.—PIERRE GUIEU.—Continuation of an article dealing with the various ways in which peat may be employed as a main or auxiliary fuel in central stations.—*Revue Générale de l'Electricité*, Dec. 22, 1917.

Installations, Systems and Appliances

Conveyors and Elevators.—W. H. ATHERTON.—Sufficient coal storage is a vital matter for the power station, and introduces problems that are conveniently solved by conveyors. The various types of conveyors and elevators for coal handling and ash handling are considered in some detail, and reference is also made to the suction method of removing ashes.—London *Electrician*, Dec. 21, 1917.

First Electric Steel-Melting Furnace in South Africa.—The shortage of many materials is affecting the mining companies in various ways and in some instances leading to new applications of electric power. For example, a recent issue of the *Journal of Transactions* of the South African Institute of Electrical Engineers contains a paper by W. Buchanan and G. H. Stanley describing what is stated to be the first electric steel-melting furnace in South Africa. This furnace was rendered necessary by the great demands of the mining industry for stamp battery shoes and dies, which can be met with difficulty owing to import restrictions. A regular supply of material amounting to about 7500 tons per annum is required, and arrangements are now being made to utilize by means of a new electric furnace existing accumulations of scrap shoes and dies. The furnace was started on Sept. 3, 1917, the output aimed at being about 60 tons of cast shoes and dies per month.—London *Electrician*, Jan. 11, 1918.

Largest High-Head Francis Turbine.—ARNOLD PFAU.—This article describes the hydroelectric equipment installed in the White River plant of the Puget Sound Traction, Light & Power Company, near Sumner, Wash. This plant contains two 18,000-hp. Francis turbines operating under a net head of 440 ft. (134.1 m.) which have developed over 44,000 hp. without any detriment to their efficiency. On account of the hydraulic conditions special engineering problems were involved, which have been solved by special features in design. A new 25,000-hp. unit is being installed, this being the largest hydraulic turbine of its type in the world.—*Power*, Feb. 5, 1918.

Electrophysics and Magnetism

Portable Roentgen-Ray Generating Outfit.—W. D. COOLIDGE AND C. N. MOORE.—This article is descriptive of the development of a complete portable Roentgen-ray generating outfit for military service in the field. The essential features of the unit are its simplicity, compactness, portability and unusually high efficiency. Seventy per cent of the generated energy is utilized in the generation of Roentgen rays. The tube has been especially developed for use in this outfit and is fully explained.—*General Electric Review*, January, 1918.

Fluorometric Apparatus for Regulating X-Rays.—H. GUILLEMINOT.—Apparatus for measuring the intensity of the incidental radiation is described.—*Revue Générale de l'Electricité*, Dec. 22, 1917 (abstracted from *Comptes Rendus des Séances de l'Académie des Sciences*, Nov. 19, 1917).

Electrolytic Precipitation of Gold, Silver and Copper.—Because of the uncertain supply of metals, particularly zinc, which is now used exclusively for precipitation in the cyanide process, it is interesting to examine electrolytic precipitation, which affords the most convenient substitute. Results obtained by this method in the laboratory have been satisfactory, but industrially success has not been great in the past. This article deals with experiments made at South African and Mexican mines with improved apparatus. In a treatment with limestone extending over two months, where 4 tons of solution was used for each ton of limestone, the cyanide apparently regenerated was 0.45 kg. (0.99 lb.) per ton of limestone, while 80 per cent of gold and 89.6 per cent of silver were precipitated. The regeneration of cyanide was greater by this method because of the large quantity of copper contained in the limestone.—*L'Industrie Electrique*, Dec. 10, 1917.

Units, Measurements and Instruments

Relations Between the Electrical Units and the Laws Underlying the Units.—This digest develops in a consecutive manner the relations between the units of an "ampere, ohm, ampere-turn, weber" system of units from which all decimal conversion factors and irrational 4π factors have been eliminated. The electrostatically defined unit charge—the coulomb—is taken as the starting point. It is advocated that beginning students be taught to carry on their calculations in a single system of units and not in a mixture of three systems, and that the system taught be the pure practical system, or ampere-ohm-volt system. Furthermore, it is contended that students should not be burdened with the relations between the electrostatic, electromagnetic, the Heaviside and the hybrid practical systems until after they have learned to think in terms of a simple factor-free system. The advantages of such a course and the manner in which the relations between the units may be rationalized and freed of the troublesome conversion factors are set forth in the preface and in the following sections of the bulletin.—*Bulletin No. 880 of the University of Wisconsin.*

Measurement of Air and Gases by the Pitot Tube.—A. H. ANDERSON.—In this article is given an explanation of the use of the Pitot tube and tables to simplify calculations.—*Power Plant Engineering*, Feb. 1, 1918.

Miscellaneous

Mica.—JAMES SCOTT.—An article descriptive of its microscopical structure and behavior.—London *Electrical Times*, Dec. 27, 1917.

Deterioration of Muntz Metal (60:40 Brass) by Selective Corrosion.—The paper reports the study of selective corrosion of Muntz metal, a material having a variety of industrial uses. The selective corrosion is illustrated by four types, including tubings, sheets and forgings. The metal becomes red in color, very weak and brittle by this type of corrosion. The condition favorable to such corrosion is the accelerating effect of

the closely adhering deposits of chloride resulting from the attack of the metal. Other conditions accelerate the corrosion, as contact with the more electronegative constituents, increase of temperature and service stresses.—*Bureau of Standards, Technologic Paper No.* 103.

Condensers with 70-Ft. Water-Level Variation.—F. R. Brosius.—A description of the substructure adopted to assure a satisfactory supply of condensing water under unfavorable conditions and to support the great weight of the power plant and equipment on unstable ground at the West End power station of the Union Gas & Electric Company of Cincinnati, Ohio. The condenser wells are five in number. The intake well is 86 ft. (26.2 m.) deep and 60 ft. (18.3 m.) in diameter. Two condenser wells will contain all recondensing equipment; each is 84 ft. (25.6 m.) deep and 86 ft. (26.2 m.) in diameter. The two discharge wells are 17 ft. (5.2 m.) in diameter. These wells are necessarily deep owing to the fluctuating water in the Ohio River, which is about 70 ft. (21.3 m.) between the extreme low-water and extreme high-water levels. The method used for sinking the larger wells is given in detail.—*Power*, Jan. 29, 1918.

Electroculture.—A description of the electrical apparatus employed to stimulate agricultural production. Experiments have shown an increased growth under this treatment as follows: Young strawberry plants, 80 per cent; old strawberry plants, 25 to 36 per cent; potatoes, 20 to 50 per cent (in the size, not the number of the potatoes); carrots, beets and tomatoes, 20 to 50 per cent. Not the least advantage noticed is the destruction of worms and insects that prey upon the plants.—*L'Industrie Electrique*, Dec. 25, 1917.

A Talk to Firemen on Saving Coal.—Charles H. Bromley.—This is a simple, straight-from-the-shoulder talk to firemen, giving the most important things to do to get the most out of coal, with the hope that firemen and their employers will become interested enough to study fuel economy further as the problem confronts them. The author deals in the main with the following sub-topics: "Employers Need Education," "Hints on the Care of Fires," "Cleaning the Fires," "A Few Hints on the Stokers" and "Some General Hints."—*Power*, Jan. 29, 1918.

Coal and Its Selection.—Walter N. Polakov.—This article includes a description of coal formation and qualities, proper selection and economical use.—*Power Plant Engineering*, Feb. 1, 1918.

Determination of Atomic Weights by Means of X-Rays.—C. W. Kanolt.—From the spectra obtained by exposing crystals of two different substances to X-rays of the same wave-length, the ratio of the distances between adjacent layers of atoms in the two substances can be easily determined, as is well known. If the relative distances are determined in the direction of each crystal axis, these results, together with the inclination of the axes to each other in each crystal, enable one to calculate the ratio of the volumes of the elementary parallelopipeds of each crystal. From this ratio and the ratio of the densities the ratio of the molecular weights can be easily calculated. From the ratios of molecular weights atomic weights can be calculated in the usual manner. After suitable apparatus has once been set up this method should permit the determination of the atomic weights of a considerable number of elements with less consumption of time and in most cases with greater accuracy than the chemical methods that have been used hitherto.—*Science*, Feb. 1, 1918.

Book Reviews

Everyman's Chemistry. By Ellwood Hendrick. New York: Harper & Brothers. 374 pages.

Intensified interest in the chemical field caused by the war makes this book timely and useful. It is a real "chemistry book," giving in popular language a view of modern progress in that field, and is designed for those who know nothing about chemistry. The book tells how chemists think and how their work enters into life and industry on every hand. Valuable technical information has been presented in an interesting, readable form, which was the author's aim. This is the second book of a modern science series planned by Harper & Brothers, intended to present the latest and most authoritative pictures of modern science in scientific and sociological fields.

Practical Electric Illumination. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 226 pages, 166 illustrations. Price, $2.

This is a condensed compilation of some of the best information on illuminating engineering practice and available apparatus. The author is well known to have the art of presenting his facts in a clear and usable form, and this book comes up to that standard. Special care has been given to the diagrams and illustrations in order to present them in a clear manner, and certain mechanical analogies have been worked out by the author to explain the phenomena of light which assist in easy conception of the principles involved. Like many compilations from various authorities intelligently made, this book is probably of greater practical value than some more pretentious works in which there is not such correlation of the different parts. Extensive use has been made of publications in current practical literature and manufacturers' engineering data. The book first takes up fundamental ideas of light and radiation and then follows with principles and units, reflectors, incandescent lamps, arc lamps, mercury vapor and tube lamps, principles of illumination design, interior illumination and exterior illumination. The index is very full and complete. The book is evidently intended to be used hand in hand with the "American Electrician's Handbook" by the same author, as frequent references are made to tables found in that book. In many cases these tables are of equal importance in illumination work with those to which room is given in this book. The matter on glare and permissible brightness contrasts is not quite up to date. A strange error which has crept into paragraph 89 is the statement that it is desirable to express intrinsic brightness in candlepower per square inch because the numbers would be awkwardly large if they were expressed in lamberts. The lambert, which is the present recommended standard of technical societies, is equal to about 0.5 candle per square inch. As a whole, however, the book is probably one of the best of its size and kind now on the market.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

45,000-KW. TURBINE ADDED TO NEW ENGLAND RESOURCES

Narragansett Electric Lighting Company Places Large New Generating Unit in Operation at Providence—Power Needed

Within the last few days a 45,000-kw. turbine-generator set has been placed in operation at the South Street steam plant of the Narragansett Electric Lighting Company, Providence, R. I., increasing the generating capacity of the station to about 80,000 kw. and making the most notable single-unit addition in New England central-station history.

The new machine, believed to be the largest size to be placed in operation in the world to date, more than doubles the station rating and institutes a most welcome source of energy under present conditions in the New England power field.

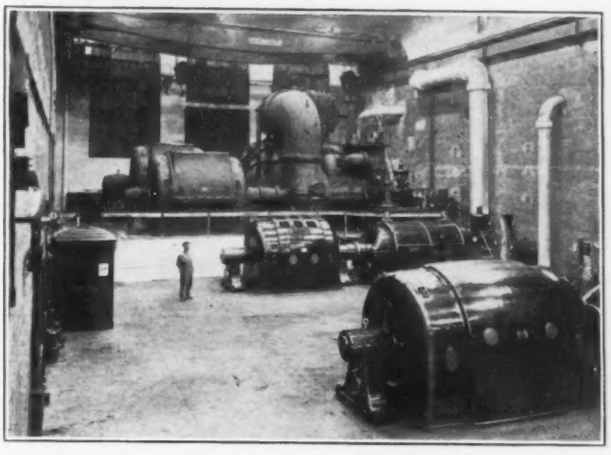
Help to Hydroelectric System

The Narragansett company is the largest central station from which the New England Power Company purchases energy. The former is at present selling the latter company over 2,000,000 kw.-hr. per week, and installation of the new unit, with its guaranteed high efficiency in operation, will benefit the New England company's hydroelectric system to a notable extent in view of the present coal shortage, besides being of great value in handling the load at Providence and elsewhere on the Narragansett company lines.

The new unit was built by the Westinghouse company and has been installed under the direction of Francis Hodgkinson, chief engineer of the manufacturing organization, and Webster Talmadge of the Westinghouse New England staff. It is of the cross-compound type, consisting of a high-pressure turbine exhausting into a low-pressure turbine, the former running at 1800 r.p.m. and the latter at 1200 r.p.m. Each drives a direct-connected generator of 22,500 kw. rating, delivering 11,000-volt, three-phase, 60-cycle energy and designed to divide the load equally between the two. The unit is supported on a structural steel foundation, weighing about 515,000 lb. (233,600 kg.), the foundation being carried on a pile and concrete foundation formerly supporting a brick chimney. Steam is supplied at 200 lb. pressure (14.1 kg. per sq. cm.) and 100 deg. superheat, and the guaranteed water rates at various loads are as follows:

Power Factor 95 per Cent		Lb. Steam per Kw.-Hr.	
Per Cent Load	Kw.	28.5-In. Vacuum	29-In. Vacuum
100	45,000	11.85	11.55
89	40,000	11.75	11.35
78	35,000	11.55	11.20
67	30,000	11.45	11.05
56	25,000	11.60	11.15
45	20,000	11.85	11.35
34	15,000	12.30	11.50

On account of the characteristics of the feed water and also because of space limitations, the condensing equipment is of the jet type. There are two No. 24 Westinghouse LeBlanc low-level condensers capable of handling 18,000,000 lb. (8,572,897 kg.) of injection water and of condensing 500,000 lb. (226,796 kg.) of steam per hour to 28-in. vacuum, with cooling water at 70 deg. Each condenser is turbine-driven through gears and can be operated separately if desired. The condensers are mounted below the turbine, and salt water from the Providence River is used for injection purposes. Two free-exhaust pipes, 42 in. (106.68 cm.) in diameter, lead from the high-pressure side of the unit to outboard discharges, and two 42-in. back-pressure valves weighing 7000 lb. (3175 kg.) each are installed. The steam supply for the turbine is taken by a 24-in. (60.96-cm.) steel pipe from a horizontal



GIANT TURBINE-GENERATOR SET WILL HELP TO OVERCOME EFFECT OF COAL SHORTAGE

boiler-room main, the turbine line being carried about 50 ft. (15.2 m.) away from the main to a U-head and thence back to the turbine-room wall and to the throttle, more than 100 ft. (30.4 m.) of pipe being installed to provide for expansion. This piping can be swayed slightly by hand, so that the turbine casing is freed from danger of injury due to pipe expansion. There are now twenty Babcock & Wilcox boilers in the plant, sixteen being rated at 600 hp. and four at 440 hp. All the boilers are equipped with seven-retort Taylor stokers. There are six steel stacks, each 217 ft. (66.14 m.) high above mean high water and 11 ft. (3.35 m.) in inside diameter.

The new unit occupies a space but 50 ft. (15.2 m.) long, 37 ft. (11.27 m.) wide and 18 ft. (5.48 m.) high. About 4,500,000 cu. ft. (127,000 cu. m.) of air per hour are required for generator ventilation, and it is estimated that if the entire output of the unit were utilized in the weaving of cotton cloth it would keep 125,960 looms busy and manufacture into fabric 574,692,000 lb. (260,000,000 kg.) of cotton per year.

The total weight of this great turbine unit is 1,380,000 lb. (625,957 kg.).

MEETING OF GOVERNORS OF ASSOCIATED MANUFACTURERS

John R. Rathom, Skillful Exposer of German Plots, Is to Address Members of the Association at Annual Banquet on March 21

A regular meeting of the board of governors of the Associated Manufacturers of Electrical Supplies will be held at 2:30 p. m. on Feb. 15 at the headquarters, New York. Final arrangements in connection with the annual meeting, as well as other important matters, will be discussed.

John R. Rathom, editor of the Providence *Journal*, which has exposed numerous German plots in the last three years, has consented to address the members of the association at the banquet following the annual meeting in New York on March 21.

MANUFACTURERS WORK TO CONSERVE INDUSTRY RESOURCES

"Manufacturer Can Manifest No Greater Patriotism than by Consulting with Group Committee Before Making Plant Extensions"

The General War Service Committee of the Electrical Manufacturing Industry has issued the following bulletin, entitled "Conservation of Industrial Resources," to every electrical manufacturer:

Your committee understands that it is the purpose of the federal government to conserve the industrial resources of the country to war needs and that when measures to that end are undertaken they will be in harmony with the following:

1. The full power of all industry, in all departments—labor, equipment and capital—must be utilized primarily for the successful prosecution of the war, to the end that all essential war products may be obtained in the quantities and at the time required.

2. Existing equipment, organizations and agencies will be utilized as far as possible with the least industrial disturbance and avoidance of too great concentration of war work in large industrial centers. It may be necessary to change the character of the work done, but every effort should be made to maintain a normal flow of trade through existing channels and conserve all industry for peace.

3. Plant extensions should not be made, or new plants created, when there is available unutilized national capacity that can be adapted to the needs of the hour.

4. Readjustment of so-called less essential business will be required only to the extent that such business interferes with the essential war program. When such readjustment is necessary the first appeal will be for voluntary action by the industrial group affected.

A function of the industrial representative of the War Industries Board will be to co-ordinate the industrial resources of the country, so as to utilize them with the least industrial disturbance. In sympathy with above course your committee urges electrical manufacturers, by means of their committee organization, to co-operate actively with the government.

During the period of the war a manufacturer can manifest no greater patriotism than by consulting with the appropriate group committee before undertaking any plant extensions.

It is not intended to deter any manufacturer from exercising individual initiative, or to check the normal growth of any business. On the contrary, it is most desirable that every manufacturer maintain his present organization at highest efficiency, making only such readjustments as will harmonize with government requirements.

It is in the interest of the electrical manufacturing industry that excess demand in the proper prosecution of the war shall be met:

1. By unutilized capacity within the group of manufacturers affected.

2. Within the electrical industry as a whole.

3. By unutilized capacity in another industry, presumably by the advice of the industrial representative of the War Industries Board.

To promote such a program, each group committee is requested to keep informed as to excess demand and surplus capacity in its respective lines, and whenever necessary to confer with the general committee.

The committee has also issued a bulletin showing its organization and stating its functions.

COMPTROLLER OF CURRENCY SEES NEEDS OF UTILITIES

Warning that They Must Be Kept Efficient and Solvent as War Measure—Protect Owners Against Unjust Loss

In his annual report, just sent to Congress, Comptroller of the Currency Williams says that national and state banks and many thousands of small and large investors have suffered seriously from the decline of the earning capacity of public utility corporations and the consequent shrinkage in the value of their securities, representing investments of many hundred millions of dollars. These losses, he adds, naturally diminish the power and disposition of the public to respond to the calls of the government for money for war.

While Mr. Williams recognizes the shortcomings of some of these corporations, he says that generally they were able to serve the needs of their communities with reasonable efficiency and to earn fair returns on the money invested in them. He continues:

Now they are threatened with ruin. If they are allowed to sink into inefficiency, much of the important war work of the government will be crippled or paralyzed.

The continued and increasing efficiency of these corporations is important for the successful conduct of the war. This efficiency is not possible with present conditions. Corporations proved by their own figures to be approaching bankruptcy cannot obtain money for improvements or maintenance. On the other hand, banks and citizens suffering severe losses from investments in the securities of these entirely legitimate and once promising enterprises will be discouraged from lending money to the government or deprived of the means to lend.

The first and most direct relief to the public utilities corporations can be given by the state public utilities commissions and municipal and local authorities, with the broad-minded co-operation of the people generally, notwithstanding the necessities of war and realizing that the more promptly its burdens are accepted the sooner they will be lifted. It is essential that forbearance and consideration be exercised by the state commissions and municipal authorities, and that the corporations also be permitted to make such additions to their charges for services as will keep in them the breath of solvency, protect their owners against unjust loss, and give them a basis of credit on which they may obtain the funds with which to meet the strain put on them by the government's needs. The breaking down of these corporations would be a national calamity.

I am impressed with the importance of early consideration by the Congress of some measure to provide, directly or indirectly, for advance of funds on some conservative basis to such of these corporations as need help most urgently, so that they may give adequate service to the government. The remedy would be unusual, but the times are unusual.

Comptroller Williams also urges that banks should not take advantage of war conditions to exact heavy interest. He gives statistics of increased material cost supplied by utility associations.

INCREASE IN RATES AT SHEBOYGAN, WIS.

Authority Granted Eastern Wisconsin Electric Company by Railroad Commission to Increase Power and Lighting Other Than Residential Rates

The Wisconsin Railroad Commission on Jan. 29 rendered a decision in connection with the application of the Eastern Wisconsin Electric Company to increase power and lighting rates, with the exception of residence lighting rates, at Sheboygan.

The company requested permission to increase the rates mentioned 0.75 cent per kilowatt-hour and to discontinue the sale of tickets at six for 25 cents.

The commission granted authority to increase power rates and all lighting rates other than residence lighting rates 0.25 cent per kilowatt-hour beginning on Feb. 1 and continuing to Aug. 1 of this year, when the former rates become effective, unless upon application the commission approves of a continuance of the rates granted under this emergency order. The minimum lighting rate was reduced from $1 to 75 cents, and permission was granted to discontinue the sale of six tickets on the electric railway for 25 cents for the period mentioned.

The company has also made application to the commission for authority to increase lighting and power rates at Fond du Lac 1½ cents per kilowatt-hour and to eliminate the sale of the six tickets for 25 cents at that point, and an application has been filed and hearings held in connection with the elimination of eight tickets for 25 cents on the Oshkosh property of the company. No decisions have been rendered on the last two applications.

FUEL ADMINISTRATION TAKES CONTROL OF OIL

Public Utilities, with Domestic Consumers, Rank Fifth in the Classes of Users Designated for Priority

By proclamation of the President, manufacturers and distributers of fuel oil, including gas oil, with an output of more than 100,000 barrels a year, are placed under the licensing system of the Fuel Administration, effective on Feb. 11.

Under the proclamation the licensee engaged in the distribution of fuel oil in that part of the United States east of the Rocky Mountains shall not without the consent of the United States Fuel Administrator make any deliveries of fuel oil to any customer of any one of the classes mentioned below until he shall have delivered to customers of every class designated by a lower number with whom he may have a contract all fuel oil for which deliveries shall be then due upon such contract. Differentials as between members of the same class may be made only with the consent and under the direction of the United States Fuel Administrator:

1. Railroads and bunker fuel. 2. Export deliveries or shipments for the United States Army or Navy. 3. Export shipments for the navies and other war purposes of the Allies. 4. Hospitals where oil is now being used as fuel. 5. Public utilities and domestic consumers now using fuel oil (including gas oil). 6. Shipyards engaged in government work. 7. Navy yards. 8. Arsenals. 9. Plants engaged in manufacture, production and storage of food products. 10. Army and navy cantonments where oil is now being used as fuel. 11. Industrial consumers engaged in the manufacture of munitions and other articles under government orders. 12. All other classes.

SAVING OF COAL MADE BY THE PUBLIC UTILITIES

Electric and Gas Companies in Twenty-nine Large Cities Report Saving of 21.2 Per Cent During Five-Day Period

Dr. Garfield announced on Feb. 6 that, if possible, the Monday closing order would be rescinded after Feb. 11, but that will be determined by weather and general conditions. Railroad embargoes will be continued indefinitely. Dr. Garfield stated in referring to the conference of Fuel and Railroad Administration officials on Feb. 5 that without exception the Fuel Administrators present bore witness to the uniform and patriotic observance of the closing order on the part of all classes of the community.

The official statement says in part:

The effect of the closing order is not easily measured statistically, the more so because of extraordinary weather conditions, but the State Fuel Administrators report that substantial savings have been effected. The most exact estimates were submitted by the secretary of the National Committee on Gas and Electric Service. These figures were furnished by electric light, power and gas companies of twenty-nine of the largest cities of the country. The weighted average of the saving in five days from Jan. 17 to 22, inclusive, was 21.2 per cent, while the saving for Monday, Jan. 28, was 25.5 per cent of the amounts usually consumed.

Mr. Garfield is informed that the public utilities concerned did not consume on other days appreciably more than the normal amount of coal as a result of the shutdown.

It is estimated that the public utilities reporting furnish a fair index of the general saving in the communities involved.

CANADA NOW GETS A WORKLESS DAY ORDER

D. H. McDougall Telegraphs "Electrical World" that as Principal Central Stations Have Hydroelectric Power Business Effect Is Slight

An order in council passed by the Dominion of Canada Cabinet on Feb. 4 on recommendation of Fuel Comptroller Magrath suspends operation of all manufacturing plants, including munitions, on Feb. 9, 10 and 11. It does not apply to Western Canada or the Maritime Provinces.

Exemptions similar to those in the United States regulation are granted. Heatless Mondays are ordered from Feb. 18 to March 25 for theaters and other amusement places. Golf, yacht, canoe, hunt and country clubs must close during March except on Wednesdays and Saturdays.

Mr. Magrath is in Washington co-operating with authorities there.

In answer to an inquiry, D. H. McDougall, president Canadian Electrical Association, Toronto, telegraphs the ELECTRICAL WORLD:

Inasmuch as all principal Canadian central stations are supplied from hydraulic power plants Fuel Commissioner's order will have little effect on the business, large part of load, used by furnaces and other munition plants, requiring no fuel. Principal loss will be from store and office revenue.

SIDELIGHTS ON THE EVENTS AT WASHINGTON

The $10,000,000,000 Which Must Be Raised, Needs of Industry, the War Finance Corporation and a Little Politics

(By Our Washington Correspondent)

A few days ago the United States Treasury disbursed $86,000,000 in one day. And now it is getting to be pretty well understood that it is necessary to raise before the end of the fiscal year for war needs of the United States and the Allies $10,000,000,000.

* * *

There must be money raised, too, with which to run business, so that business may produce in taxes the money with which to run the war. In this situation, now being driven home with force in Washington, it is proposed that Congress shall create a "War Finance Corporation," with a cash capital of $500,000,000 and authority to issue and sell $4,000,000,000 in short-term notes, for financing private war industrial operations. These phrases are other terms for the creation again of priorities—this time, priorities in money and for private industry, not for the government. It is a trifle early to say what Congress will do. The best judgment obtainable in Washington, where so many leaders in the industrial world are now living for the period of the war, is that some form of "War Finance Corporation" to keep private industry going has become a vital necessity.

* * *

Many other very interesting things are coming to the surface. A good portion of the money that was tied up in Russian contracts is, of course, diverted; and recently the French government, pointing out that nothing is gained by paying for machinery and materials in this country unless ships can be furnished to carry the machinery and materials to France, had its representatives here discuss with American contractors a basis for the liquidation of contracts, and millions of dollars of machinery contracts were so liquidated. As to Russia, in particular, business men now in Washington insist that there is no cause for alarm concerning the future.

* * *

There is much gossip in regard to the growing power and responsibilities of Secretary McAdoo of the Treasury Department. If there is one thing in the way of the easy passage by Congress of the "War Finance Corporation" bill, it is the fact that Secretary McAdoo has had thrust upon his shoulders almost too much work, almost too much responsibility. None the less Secretary McAdoo seems to bear up under the strain, and his friends are sincerely rejoicing that if politics does grow out of his enormous powers and responsibilities he stands a very good chance of being the logical nominee to succeed his distinguished father-in-law in the Presidential chair.

* * *

Why, the question is asked, has Edward R. Stettinius, formerly of J. P. Morgan & Company, who for more than three years had absolute control of purchases of the Allies in the United States, been brought to Washington as a "surveyor general" for army purchases, only to report to the highest authorities through a series of steps beginning with an army colonel? The idea of Mr. Stettinius "reporting" through boards and councils and subordinates, in view of the fact that he is one of the best qualified men to direct all war purchasing, is really laughable. If the war council of the Secretary of War decides that it is policy to purchase a large quantity of this or that, General Goethals, the new acting quartermaster-general, is informed; and then General Goethals asks Colonel Palmer M. Pierce, the new director of purchases, to go ahead, and then Colonel Pierce refers the request to Mr. Stettinius. The latter's recommendation then goes to Colonel Pierce, and from him to General Goethals, and the latter is to let the contract. In case of disagreement, Secretary Baker is referee. It seems a roundabout method, and there is talk of reassigning Mr. Stettinius. Perhaps it is not roundabout in practice. The best thing to do in Washington is to have confidence.

LABOR ADVISORY COUNCIL IS OF LARGE IMPORTANCE

National Body Will Formulate Program and Recommend Administrative Machinery on Every Phase of Employment Problem

The first official recognition of the need for a broad consideration of the labor problem was the appointment of an advisory council to the Secretary of Labor.

The council will consider the establishment in the Department of Labor of agencies to perform the following functions:

1. A means of furnishing an adequate and stable supply of labor to war industries. This would embrace:
   (a) A satisfactory system of labor exchanges.
   (b) A satisfactory method and administration of training of workers.
   (c) An agency for determining priorities of labor demand.
   (d) Agencies for dilution of skilled labor as and when needed.
2. Machinery for immediate and equitable adjustment of disputes in accordance with principles to be agreed upon between labor and capital and without stoppage of work, dealing with demands concerning wages, hours, shop conditions, etc.
3. Machinery for safeguarding conditions of labor in production of war essentials, including industrial hygiene, safety, women and child labor, etc.
4. Machinery for safeguarding conditions of living, including housing, transportation, etc.
5. A body to assemble and present data collected through existing governmental agencies or by independent research to furnish information necessary for effective executive action.
6. A publicity and educational division, developing sound public sentiment, securing exchange of information between departments of labor administration, and promoting in industrial plants the local machinery helpful in carrying out a national labor program.

The council is headed by John Lind, former Governor of Minnesota and envoy to Mexico, representing the public. Waddill Catchings, president Sloss-Sheffield Steel & Iron Company and Platt Iron Works, and A. A. Landon, general manager American Radiator Company, represent employers. Labor members are John B. Lennon, treasurer American Federation of Labor, and John J. Casey, former member of Congress. Dr. L. C. Marshall, University of Chicago, is the economist member, and Agnes Nestor, Chicago, represents women.

MEMPHIS MEETING OF THE ELECTRICAL INSPECTORS

Annual Meeting of Western Association Discusses Conservation of Foodstuffs, Munitions and Property by Means of Inspection

Conservation of foodstuffs, munitions of war and property by means of inspection was the keynote sounded throughout the thirteenth annual meeting of the Western Association of Electrical Inspectors at Memphis on Jan. 29, 30 and 31.

Important topics discussed were: "Distinguishing Electrical Signal Systems," "Hazards in Elevator Wiring," "Methods of Grounding Secondaries," "The Demand Factor of Lighting, Elevator and Power Circuits," "Electricity on the Farm" and "War Service of the Underwriters' Laboratories." Some of the points brought out and conclusions arrived at by the convention follow:

SUMMARY OF POINTS DISCUSSED

The electrical inspector must not only make electrical recommendations, but he should compel the property owners to employ sufficient capable and instructed watchmen and install adequate signal protective devices. In making recommendations the inspector should not merely say, "Overhaul the job," but should give specific recommendations that can be complied with immediately by the non-electrical man who is the property owner.

Electric signal systems approved by the Underwriters' Laboratories should be allowed, notwithstanding the fact that they do not comply with the National Electrical Safety Code requirements on high-voltage bell wiring.

The opinion prevailed that wires in elevator shafts should be inclosed in rigid conduit instead of armored cable as allowed by the National Electrical Safety Code, because the latter, if shaken loose from holdings by vibration or other means, would have a tendency to swing against the moving elevator and produce a fire and life hazard.

General discussion showed that many methods are used in grounding the secondaries, but it was agreed that the matter must be considered under local existing conditions in the municipalities. The Memphis Gas & Electric Company assumes the ground-wire responsibility and does not allow contractors to make grounds on the street side of the water mains as recommended in the code. Central stations can be shown that they should co-operate in this problem, but should not be forced by an ordinance to shoulder the entire responsibility.

By testing, the demand factor of power, elevator and lighting circuits can be determined, and if used in calculating the size of wire instead of the hard and fast rule of 100 per cent a conservation of from 25 to 30 per cent of copper can be made.

Farm-lighting systems help in obtaining efficient methods for needful farm production and make farmers contented to stay on the farm, where they can enjoy all the conveniences of city life.

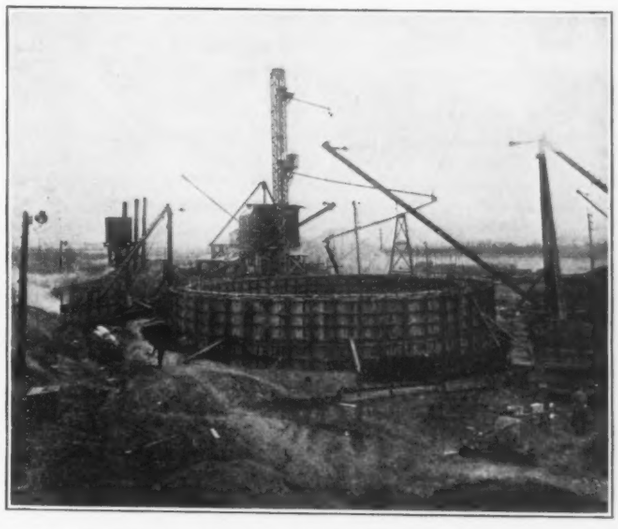
The Underwriters' Laboratories have standardized specifications in fire hose and fabricated roofing materials for war purposes, thus making it possible for the government to obtain materials with several times the speed that could have been secured under ordinary conditions. Efficient inspectors were valuable because of the fact that the government would have been compelled to secure and train men with a great loss of time.

The nominating committee named the following for officers: President, Frank L. Lucas; first vice-president, C. K. Cregier; second vice-president, K. W. Adkins; secretary and treasurer, W. S. Boyd; executive committee, Oscar W. Tryham, chairman; R. E. Moran, H. M. Beal, H. J. Clark, C. R. George, C. M. Tart and the officers.

PROGRESS IN THE NEW PLANT AT KANSAS CITY

Co-operation from Federal Authorities in Granting Necessary Priority Orders Is Helping Construction of the Large Station

Construction of the new power plant of the Kansas City Light & Power Company at Kansas City, Mo., is progressing at a satisfactory rate. Gratifying co-operation has been received at every step from the federal agencies. An original blanket priority order for all materials and equipment had been granted; while this was canceled later, priority orders are being granted in detail on various items as their need arises.



PRIORITY ORDERS HELP THIS NECESSARY CONSTRUCTION

The experience of power users and domestic consumers in Kansas City this winter has demonstrated the real need for the new station. The peak load on the central stations in Kansas City this winter for street railway, light and power has been 57,000 kw., and 13,000 kw. of business has been cut off or denied. The light company has not solicited any new business for two years. It is estimated that Kansas City will use at least 90,000 kw. next winter if the energy is available.

The building plants provide for 300,000 kw. in the unit as laid out, of which 40,000 kw., in two 20,000-kw. machines, is in the first installation, expected to be in service by Nov. 1, 1918.

The plant is being erected on twenty-five acres (10.11 hectares) of river-bottom land, adjoining the Missouri River.

PROGRAM FOR A. I. E. E. MIDWINTER CONVENTION

At New York Convention on Feb. 15 and 16 Circuit-Breaker Ratings and Meters and Measurements Will Be Discussed

The sixth annual midwinter convention of the American Institute of Electrical Engineers will be held Feb. 15 and 16 in the Engineering Societies Building, New York.

On account of war conditions the meetings and papers committee, with approval of the directors, has decided to make the convention purely a business meeting. Therefore no entertainment features or excursions have been included.

The convention will include four technical sessions on the morning, afternoon and evening of Friday and on Saturday morning. A strictly informal dinner will be held between the afternoon and evening sessions on Friday.

The regular monthly meeting of the board of directors will be held on the preceding Thursday at 8 p. m. at Institute headquarters.

The program follows:

FRIDAY, FEB. 15

10:30 a. m.—Opening remarks by President E. W. Rice, Jr.; session on circuit-breaker rating: "Rating and Selection of Oil Circuit Breakers," E. M. Hewlett, J. M. Mahoney and G. A. Burnham.

2:30 p. m.—Session on meters and measurements: "A New Standard for Current and Potential," C. T. Allcutt; "The Thermoelectric Standard Cell," C. A. Hoxie; "The Character of the Thermal Storage Demand Meter," P. M. Lincoln; "Measurement of Power Losses in Dielectrics of Three-Conductor High-Tension Cables," F. M. Farmer.

6:30 p. m.—Informal dinner at Café Boulevard, Forty-first Street and Broadway; subscription, $2 per cover. President Rice will speak on a timely topic at the dinner.

8:30 p. m.—Lecture, "Some Applications of Electromagnetic Theory to Matter," Dr. A. C. Crehore; to be followed by discussion.

SATURDAY, FEB. 16

10:30 a. m.—Session on alternating-current commutator motors: "Commutation in Alternating-Current Machinery," Marius A. C. Latour; "The Secomor—a Kinematic Device Which Imitates the Performance of a Series-Wound Commutating Motor," V. Karapetoff; "The Polyphase Shunt Motor," W. C. K. Altes.

CANDIDATES PROPOSED FOR NOMINATION IN A. I. E. E.

Comfort A. Adams and J. Franklin Stevens Named for President, but Latter Requests Withdrawal of His Name

The following candidates have been proposed for nomination by petition in the American Institute of Electrical Engineers:

For president—Comfort A. Adams, Cambridge, Mass.; J. Franklin Stevens,* Philadelphia.

For vice-presidents—Allen H. Babcock, San Francisco; William B. Jackson, Chicago; F. B. Jewett, New York; Raymond S. Kelsch, Montreal; Harold Pender, Philadelphia; John B. Taylor, Schenectady.

For managers—Charles I. Burkholder, Charlotte, N. C.; G. E. Faccioli, Pittsfield, Mass.; Morton G. Lloyd, Washington; Frank D. Newbury, Pittsburgh; Walter I. Slichter, New York.

*This candidate has requested that his name be withdrawn.

ELECTRIFY ROADS AND SAVE WATER POWER, SAYS MR. RICE

Addressing Lynn Section, the A. I. E. E. President Draws Needed Lessons from the Penalty of Our Wasteful National Policies

Before 600 members and guests of the Lynn (Mass.) Section of the American Institute of Electrical Engineers on February 2 E. W. Rice, Jr., president of the national body and of the General Electric Company, urged general electrification of railroads and comprehensive development of water powers in the United States as a means of conserving fuel and increasing transportation efficiency under the war conditions that now exist.

The annual dinner of the Lynn Section was held in the new Thomson Research Laboratory at the River Works of the General Electric Company, and the speakers also included W. C. Fish, general manager of the Lynn works, toastmaster; Lieutenant Governor Coolidge of Massachusetts, Mayor Creamer of Lynn, Capt. F. P. Dawe of the Second Canadian Artillery, and Prof. Elihu Thomson, consulting engineer of the company. The Lynn Section, with 1650 members, is the largest in the country. Chairman J. M. Davis presided. The meeting dedicated the new laboratory to the service of the company, and in responding to the call of the toastmaster Professor Thomson contrasted the early facilities at his disposal with the present plant and gave many interesting reminiscences of electrical development. Concluding, he summarized the vital importance of research under war conditions as well as in peace.

MR. RICE ON WAR PROBLEMS

In prefacing his address, Mr. Rice paid high tribute to the achievements of the country in war preparations since the declaration of hostilities. He shared widespread regret that these preparations were not begun two years earlier, but pointed out that it is a waste of time to dwell upon this aspect of the war problem. The single object to-day is the winning of the war, and the utmost efforts and highest co-operation are needed to accomplish this.

The country is indeed fortunate, the speaker said, that its President is the true spokesman of its ideals, and because of his genius he has become the spokesman for all on the Allied side. It is fortunate for the world's future that the utterances of President Wilson exhibit no ground for looking toward an inconclusive peace. The vital necessity is to throw our full strength into our military, naval and industrial power. It is a happiness to think that no President has ever received such support as the country has given Mr. Wilson since war was declared. All interests want to give advice to the administration, but apparently the Democrats want no advice from the Republicans.

"Recent events have mystified, but I hope have not discouraged, the average citizen," said Mr. Rice.

The speaker pointed out how the entire country had been stunned by the recent closing order and has become nervous and critical as a result. He emphasized the point that the country has not made a failure of its war preparations, but that all is moving as well as could be expected under the circumstances of unpreparedness under which the United States took up its huge task.

"Notwithstanding a distinguished authority," said

Mr. Rice, "a million men cannot spring to arms overnight, nor can all the great mechanism of war be produced in a year. A certain minimum time is necessary to get ready, and all we can do is to see that that minimum is not unduly prolonged.

"This is a people's war—a war for democracy. It should not be handled as a war to be conducted merely by the party in power; all the people must be represented. The questioning attitude of the country arises from the fear that the ability and experience and wisdom of the whole country is not being called upon. Governmental methods suited to peace times do not fit war conditions."

Mr. Rice said that something like the coalition government formed in England appears desirable here. There is no lack of confidence in the good intentions of our leaders, but we need the wisdom and experience of all the country and not of one-half of it; we need men who take to team play as a duck takes to water. Now that the government has taken over the railroads, ability in the representatives of the people is more needed than ever. In future there will be a more general interest in public affairs, and the speaker urged all engineers to take such an interest, maintaining that all classes of professional and business men should be represented in the government.

LESSONS OF THE COAL FAMINE

Discussing the economic value of water-power development and railroad electrification, Mr. Rice said in part:

We are now in the midst of an extraordinary coal famine due to causes which it is unnecessary and perhaps undesirable for us to attempt to outline. However, I would like to point out in the first place how much worse the situation might have been were it not for the contributions of the electrical engineer and manufacturer, and second, how much better our condition might have been if our contributions had been more extensively utilized.

Suppose we assume that the present serious situation is due to a lack of production of coal. It is comforting to consider to what extent conditions surrounding such production have been improved and how the amount of coal mined has been already increased by the use of electrical devices in connection with coal mining—such for example as the electric light, electric coal cutters, electric drills and electric mining and hauling locomotives. I have no figures before me, but I think it is a fairly safe assumption that the amount of coal mined has been increased at least 25 per cent on the average by the employment of such electrical devices. If this estimate were cut down to 10 per cent, it would still leave an increase in the tonnage of coal produced of something like 50,000,000 tons during the past year.

If, on the other hand, the difficulty is not due to a shortage in the production of coal, but rather to the failure of the distributive agencies of the country, it is interesting to see how this difficulty would have been largely removed if the railroads of the country were operated by electricity instead of steam.

Where electricity has been substituted for steam in the operation of railroads, 10 to 50 per cent increase in actual capacity of existing tracks and other facilities has been demonstrated. This increased capacity has been due to a variety of causes, but largely to the increased reliability and capacity, under all conditions of service, of electrical locomotives. This has enabled a speeding up of the train schedules by some 25 per cent, under average conditions. Of course, under the conditions which prevail in extreme cold weather, when the steam locomotives practically go out of business, the electric locomotives make an even better showing.

It is therefore not too much to say that if the roads of the country were now electrified no breakdown of our coal supply, due at least to failure of distribution, would exist.

But this is not all. It is estimated that something like 125,000,000 tons of coal were consumed by the railroads in the year 1915. Now, we know from the results already obtained from such electrical operation as we have had in this country that it would be possible to save at least two-thirds of this coal if electrified locomotives were substituted for the present steam locomotives. On this basis there would be a saving of over 80,000,000 tons of coal. Even if only half of this saving were realized in practice, I think we can justly claim that there would have been no coal shortage at present if the roads had been electrified.

It is estimated that there is not less than 25,000,000 hp. of water power available in the United States, and if this were developed and could be used in driving our railroads, each horsepower so used would save at least 6 lb. (2.7 kg.) of coal per horsepower-hour now burned under the boilers of our steam locomotives. Unfortunately this water power is not uniformly distributed in the districts where the railroad requirements are greatest, but the possibilities indicated by the figures are so impressive as to justify careful examination as to the extent to which water power could be so employed and the amount of coal saving which could be realized.

The terrors of these "heatless days" will not have been without benefit if they direct the attention of the people and of our lawmakers to the frightful waste of two of our country's most valuable assets—our potential water power and our coal reserves. The first, potential water power, is lost because it is allowed to run to waste, undeveloped, unused. The second asset, coal, is wasted for exactly the opposite reason. It is being used, but in a frightfully ineffective and inefficient manner.

The waterfalls constitute potential wealth which can only be truly conserved by development and use — millions of horsepower are running to waste every day, which once harnessed for the benefit of mankind become a perpetual source of wealth and prosperity.

It is really terrifying to realize that 25 per cent of the enormous amount of coal which we are digging from the earth each year is burned to operate our railroads under such inefficient conditions that the average of 6 lb. of coal is required per horsepower-hour. The same amount of coal burned in a modern central power station would produce equivalent to three times that amount of power in the motors of an electric locomotive, even including all the losses of generation and transmission from the source of power to the locomotive.

Where water power may be utilized, as in our mountainous districts in the West, all of the coal used for steam locomotives can be saved. In the middle Atlantic States, however, water powers are not sufficient, and it will be necessary in a scheme of electrification that the locomotives be operated from steam-turbine stations.

We should not be justified in being so confident of the benefits of electrification of railroads if every element in the problem had not been solved in a thoroughly practical manner. The electric generating power stations, operated either by water or by steam turbine, have reached the highest degree of perfection, efficiency and reliability, while the transmission of electricity over long distances with reliability has become a commonplace.

It may be said that the present is not a propitious time in which to deflect any of the country's capital into railroad electrification. I think that in spite of the enormous advantages of which I have spoken, we should be inclined to agree with such a point of view if it were not for the recent unpleasant demonstration of the apparent failure of our railroad transportation systems to meet the demands which have been placed upon them by the industries, aggravated it is true by the war conditions and also by the unkindness of the weather.

What assurance have we that the present conditions are temporary, and even if they improve as they surely shall with the coming of warm weather, what are we going to do next winter? Of course, even if we should start electrification at once, we could not have all our railroads electrified by next winter, but we could have a good start, and as was said about the resumption of specie payments, "The way to resume is to resume," so "The way to electrify is to electrify."

LESSONS OF THE WAR FOR ELECTRIC UTILITIES

The Problems of Capital, Rates, Extensions, Operating Cost, Fuel Supply, Transportation and Public Policy

BY JOHN F. GILCHRIST

[The following paragraphs are extracts from a timely address made by Mr. Gilchrist, vice-president Commonwealth Edison Company of Chicago, before the Indiana Engineering Society, Indianapolis, on Jan. 25.]

It seems to me that these coal holidays have demonstrated most conclusively one thing, that if there was anything in which this country was not prepared it was its lack of preparation in its transportation facilities, in its transportation system. I believe that, owing to shortsighted policies of the management of transportation systems which in turn developed a hostility among our people until the transportation systems were not accorded the support they should have had, the factor which they were in the prosperity of the country was misunderstood, or not understood, to such an extent that it has resulted in the most deplorable unpreparedness of transportation facilities.

Necessity of Resourcefulness

The utilities, and the railroads too, have without doubt brought much of the attitude, if not all of the attitude, of the people upon themselves, and the best thing that has happened to the utilities of the country, in my judgment, is the general establishment of commissions in the various states for the regulation of the utilities. I venture the assertion that if those commissions (a very large percentage of which are working honestly and intelligently to grasp the utility business and to work out the problems with which they are confronted) had had another five years before the breaking out of this war, our utilities would have been found to have been in very much better position to resist the demands which are being made upon them than they are to-day.

I believe it is only by the education of the people, by a period of overcoming the prejudice and the rightful aversion which many of our people feel toward the public utilities, and by educating them to the fact that the prosperity of the utility and the prosperity of the community are so closely linked up together that one cannot be prosperous without the other, that matters will be improved.

The growing difficulty in placing their capital stock impressed itself very forcibly upon the utilities. This was very largely a question of lack of capital in the country, because when the government began to go into the market for money, selling its securities, not only did it clean the money up so that the investor in other shares and bonds could not be found, but the government was in the market sixty days of last year, and indications are that it may be in the market anywhere from ninety days to six months this year, and during the time when the government is in the market it is not patriotic, ethical or practical for any one else to try to sell securities. It cannot be done.

Increased Costs and Stationary Rates

In many companies the increased costs, while the rates remained the same, left the margin of net narrower and narrower, and it was impossible to show earnings which were an inducement to the investor.

The great increase in expense was increase of cost for fuel. Some of the companies had provided themselves with mines and were in a position where the increase in the cost of fuel did not affect them so much as it affected the average concern that purchased its fuel under contract or on the market, because if the utilities had favorable contracts with coal companies they were rarely made—hardly ever made, you might say—for more than two years, and frequently for only one year, and that time was soon gone.

So we come to a situation where there are only one or two things to do for the utilities. Utilities must either stop spending money or they must find some way of raising money, and in order to raise money they must be able to make a very good showing, because in these times the industries are making such wonderful returns on the capital invested in their business that they naturally attract what capital there is and the attention of investors, so that the tendency is to get away from the securities of the public utilities.

Growth and Strength Must Be Maintained

The utilities must be kept growing and kept strong, and the utilities must go to the commissions in their various states and must ask for relief and for prompt relief, and ask it as a war emergency. I do not think it is fair to ask the commissions to pass quickly on the situation for anything other than as a war emergency; because if it were done on any other basis it might be quite possible that utilities would get by, as the saying is, without a proper investigation as to their invested capital and what they were fairly entitled to in the matter of rates and in the matter of return on that capital. On the other hand, it is not fair to the country and it is not fair to the utilities which have this responsibility thrust upon them to attempt to get at an adjustment of rates by the appraisal method, because there are not engineers enough in the country, especially in view of the demand the war is making upon them, to appraise these properties and get at the results in that way, in order to be of any service in the war.

Another thing which the utilities must do, and which they, of course, must have the approval of the regulating bodies to do, is to shut down absolutely on the spending of money for extensions for anything which is not essential to the winning of the war. I know a case within the Middle West territory where, in a mining situation, $250,000 was asked and put up promptly to build the necessary lines to and in the necessary plant in order to equip those mines, so that they could turn out promptly the product which is so badly wanted by our nation, and it is perfectly fitting that that should be done.

I can cite a case in Ohio where a manufacturing institution was taking at the outbreak of the war a very large amount of power from the electric utility and as a result of war orders it more than doubled its demand. In the meantime the costs had gone up so that the price under a five-year contract was so low that the utility was losing on that one customer $50,000 a month, and it stood the gaff for ten months or thereabouts, until it finally got its courage up and went to the Ohio commission and got, very cheerfully, relief on a showing of the situation.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month on the next-to-last text page.

Los Angeles Synchronous Club.—At the Jan. 17 meeting of the Synchronous Club, lecture No. 7 of the synchronous electrical course on "Motor Applications" was given by R. H. Cates, power engineer Southern California Edison Company.

Springfield Engineers' Club.—H. B. Lewis, plant superintendent of the Central Union Telephone Company, has been elected president and J. R. Hughes, assistant engineer State Public Utilities Commission, has been elected secretary of the Springfield Engineers' Club of Springfield, Ill.

Schenectady Section, A. I. E. E.—Bassett Jones, consulting electrical engineer, associated with Henry C. Meyer, Jr., of New York City, presented a paper on "Standardized Flexible Distributing Systems in Industrial Plants" at a meeting of the Schenectady Section of the A. I. E. E. held Feb. 1.

Annual Meeting of the Barstow Club.—The Barstow Club, an organization of the employees of the Sandusky Gas & Electric Company of Sandusky, Ohio, held its annual meeting at the office of the company recently and elected Albert Bitzer of the electric department president and Frank Kelly of the gas department secretary.

Jovian Electric League of Kansas City.—The January meeting of the Jovian Electric League of Kansas City, held Jan. 25 at the Muehlebach Hotel, was distinguished by the presence of many out-of-town visitors, including some Jovians now in army service. H. P. Wright, president of the H. P. Wright Investment Company, delivered an address on "The Outlook—Business Present and Future."

Northwest Electric Light and Power Association Committees Appointed.—President Talbot of the Northwest Electric Light and Power Association recently appointed the following committees for the association year 1917-1918: Public policy committee—F. T. Griffith, chairman; H. L. Bleecker, Elmer Dover, F. A. Harmon, J. A. Laing and A. W. Leonard. Hydroelectric and technical committee—George E. Quinan, chairman; R. M. Boykin, J. B. Fisken, L. T. Merwin, F. D. Nims and H. H. Schoolfield. Labor study committee—S. R. Inch, chairman; C. S. MacCalla and W. H. McGrath. Electric-range committee—W. R. Putnam, chairman; M. C. Osburn and A. C. McMicken. Program committee—Lewis A. McArthur, chairman; R. W. Clark, C. P. Osborne and G. C. Sawyer. Entertainment committee—C. R. Young, chairman; G. G. Bowen, W. H. Lines, A. S. Moody and Carl L. Wernicke.

Jovian Electric League, Los Angeles.—At the regular Wednesday luncheon of the league, Jan. 30, Senator L. H. Roseberry spoke on "Some Modern Phases of Socialism." L. D. Wishard of Pasadena, who has done special Y. M. C. A. work in Europe, gave a talk on this work. James M. Colkitt, manager Los Angeles branch John A. Roebling's Sons Company of California, was chairman of the day.

San Francisco Electrical Development and Jovian League.—The Jan. 23 meeting of the association was designated "Architects' Day," local members of the American Institute of Architects being invited. The subject discussed was "The Architect's Relation to the Electrical Industry." Spokesmen for the architects were Louis C. Mullgardt, B. R. Maybeck and Sylvain Schnaittacher, and for the electrical interests H. C. Reid and H. P. Pitts.

Pacific Coast Electrical Supply Jobbers' Association.—The annual meeting of the Pacific Coast Electrical Supply Jobbers' Association was held at Del Monte, Cal., Jan. 24-26. At the open meeting a paper on the conservation of labor was read by E. J. Wallis, Pacific Coast manager Western Electric Company. The annual election of officers resulted as follows: President, W. S. Berry; secretary, Albert H. Elliot; new member executive committee, Tracy E. Bibbins.

Association of Iron and Steel Electrical Engineers.—For the ensuing year the following members will act as chairmen of the respective committees of this association: W. T. Snyder, chairman standardization committee, National Tube Company, McKeesport, Pa.; W. O. Oschman, chairman power committee, Oliver Iron & Steel Company, Pittsburgh, Pa.; A. H. Swartz, chairman publicity and promotion committee, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; K. H. Cederland, chairman electric furnace committee, Duquesne Steel Works, Carnegie Steel Company, Duquesne, Pa.; J. F. Kelly, chairman membership committee, National Tube Company, McKeesport, Pa.; Walter Greenwood, chairman safety committee, Carnegie Steel Company, Youngstown, Ohio; B. W. Gilson, chairman educational committee, Carnegie Steel Company, Youngstown, Ohio; E. Friedlander, chairman editing committee, Carnegie Steel Company, Edgar Thomson Works, Braddock, Pa.; A. H. Swartz, chairman convention committee, Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.; W. C. Kennedy, chairman electrical development committee, Standard Seamless Tube Company, Ambridge, Pa.; F. D. Egan, chairman finance committee, Pittsburgh Iron & Steel Foundries Company, Midland, Pa. The next annual convention will be held either in New York or Baltimore Sept. 9-13, 1918. A paper on "Alternating-Current and Direct-Current Skip Hoists" will be presented by Mr. Lindquist of the Otis Elevator Company at the Pittsburgh Section meeting at the Hotel Chatham, Feb. 16.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Increase in Rates in Illinois.—The Southern Illinois Light & Power Company has filed a petition with the Illinois Public Utilities Commission seeking to increase rates in Litchfield and Hillsboro.

Depreciation Order Upheld.—The Appellate Division of the New York Supreme Court, First Department, has handed down a decision dismissing a writ of certiorari obtained by the New York Railways Company and affirming an order made by the New York Public Service Commission, First District, requiring the railway company to set aside 20 per cent of gross operating revenues, month by month, to provide for maintenance and depreciation of its properties. The commission order was made as a result of reorganization proceedings relative to the old Metropolitan street railway system. The New York Railways Company has been setting aside the 20 per cent required, although contesting the power of the commission to determine what amount should be so set aside for the purpose and for what it should be expended. The company contended that its directors rather than the commission should determine the amount of the company's depreciation reserve.

Municipal Plant Abandons Plan to Decrease Rates.—The Indiana Public Service Commission has dismissed a petition filed by the city of Crawfordsville for authority to decrease electric rates. On Nov. 30, 1917, the city of Crawfordsville filed with the commission its petition praying for authority to decrease electric light and power rates. F. H. Miller, superintendent of the municipal electric light and power plant, in asking that this petition be dismissed, filed with the commission a resolution by the Mayor and Common Council directing that this action be taken. In its decision the Public Service Commission says: "It appearing that the municipality of Crawfordsville, as now organized, desires this petition dismissed; it being known to this commission that the rates charged for electric energy by petitioner are, compared with rates generally charged in Indiana cities of like size, generally low and not extortionate or unreasonable; it being further known to this commission that the costs of future operation during the war period are uncertain but with an upward tendency, and also there being no protest received against the action of said Common Council and Mayor, the prayer to dismiss will be granted, with the modification that said dismissal will be without prejudice to the interest of any party."

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Hartford (Conn.) Electric Light Company Dividend Reduced.—An official statement says: "The directors have voted to decrease the dividend payable Feb. 1, 1918, from the 10 per cent to the 8 per cent basis, because it has been found that the increase in the price of energy made last July is insufficient to compensate both for the increase in the cost and for the reduction in revenue arising from the curtailment in the use of electric energy by the public."

American Light & Traction Results.—The increase in total gross business of the companies controlled by the American Light & Traction Company for the year ended Dec. 31, 1917, was $2,307,138. The normal increase in net which would be expected to follow this large increase in gross has been offset by large increases in operating costs as follows: Increased cost, coal and oil, $984,700; increased cost, operating labor, $320,300; increased cost, labor and materials, $1,305,000; increased taxes—federal, $618,000; increased taxes—other taxes, $87,000; total, $2,010,000.

Insure the Men at the Front.—To safeguard American soldiers and sailors and their families, it is imperative that the fighting forces avail themselves of the full privileges conferred by the military and naval insurance act. For his own benefit and for his family every enlisted man and officer in the army and navy should take the full $10,000 insurance. Insurance of almost $4,000,000,000 has already been applied for, but this great total is only a beginning. The army and navy should be 100 per cent insured. Persons in service before Oct. 15, 1917, must apply on or before Feb. 12, 1918. Those who joined after Oct. 15, 1917, have 120 days from the date of enlistment in which to apply.

Louisville Company Releases Coal for the Public.—About 5000 homes were warm during the week of Jan. 28 because the Louisville Gas & Electric Company, through Donald McDonald, vice-president and general manager, threw on the open market at cost a reserve supply of 3500 tons of high-grade West Virginia bituminous coal. This coal, bought last summer, had been held until it was assured that the company's own new mines in western Kentucky could meet all possible requirements. At the earliest moment the coal was sold to the public at cost to relieve a very serious shortage. Householders sent their own conveyances while dealers also got in line. The cost at the company storage shed was $5.25, below the market price.

Illinois Properties Seek Rate Increase.—A general increase in electric and gas rates, as well as street-railway fares, is asked in a petition filed by thirteen subsidiary companies of the Illinois Traction System before the Illinois Public Utilities Commission on Jan. 31. The increase asked in electric rates is from 6 to 20 per cent. The petition recites that, owing to the abnormal conditions caused by war and causing great increase in cost of producing electric and gas service, the companies are in need of immediate relief. Coal increases alone are said to be $350,000. The commission has set Feb. 19 for a hearing.

Damage to Tacoma Power Plant.—Llewellyn Evans, superintendent Electric Works, Tacoma, Wash., states in regard to the damage done to the power plant by a recent flood: "The Tacoma municipal power plant was injured by flood during the last two weeks of December and was compelled to cut off two waste-power customers and to purchase some power. The repairs necessary to put the plant in normal shape again include the clearing of the intake and pondage behind the dam and the replacing of liner rings in the turbines. This plant has 20,000 kw. capacity in four units and is situated on the Nisqually River, which is a glacial stream. The operating head is 425 ft. The high water was 30 per cent higher than at any other time in the history of the plant. It was caused by hot winds melting the mountain snow, and by an incessant rainfall. Water came up 7 ft. in the basement of the power house, the surface of the water reaching within 2 in. of the exciter bus. The operating force prepared a temporary cable bus while the water was rising. Continuance of the flood brought down sand and logs and uprooted trees in such quantities that the intake was piled full, and even with a donkey engine and the liberal use of dynamite it was difficult to keep enough water running through the grate bars to run the plant. The two 8-ft. by 10-ft. wash-out gates were wide open but became choked so as to be of no use. The plant is provided with a 1000-ft. settling channel which was washed out daily, removing a layer of sand and silt 7 ft. deep. The regulating reservoir at the plant also accumulated 8 ft. of sand in the bottom, but still the water was dirty enough to cut the wearing parts of the waterwheels, resulting in the most serious damage. To make repairs to these, liner rings around the runners will have to be renewed, the sand-filled water having put the finishing touches to five years of wear. The damage at the intake can be brought back to normal readily with a derrick and orange-peel bucket now being installed. The waste-power customers were the American Nitrogen Products Company, which uses about 3000 kw., making sodium nitrate by the arc process, and the Bilrowe Alloys Company, which uses 1500 kw. in smelting ferro-manganese. The city purchased about $600 worth of power from the Puget Sound Traction, Light & Power Company, with which it has a 12,000-kw. tie line."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Admission of Evidence.—The admission of the evidence of an experienced telephone lineman that electrical wires will break in a certain manner was not a prejudicial error, the Supreme Court of Kansas held in Lewis vs. Harvey (168 P. 856).

Care Required of Electric Wires in Mines.—The employer must exercise the utmost care and skill not only in management and maintenance of electric wires in a mine but in their construction, proper construction of such wires being as necessary to the employee's safety as maintenance thereof after construction, the Court of Appeals of Kentucky held (198 S. W. 724).

Rates Requiring Summer Consumer to Pay Full Annual Rate.—Water rates at a summer resort are held in the Maine case of Briggs versus Peaks Island Corporation (P. U. R. 1917 E. 750) not unjustly discriminatory because they require the summer taker to pay the full yearly rate where the plant was built for and is measured by the summer demand and the year-round takers are the incidental consumers.

Foreman Not a Contractor.—An award of the Industrial Accident Commission must be sustained if there is any evidence to support its finding that the injured person was an employee of the party from whom compensation is sought, the District Court of Appeals of California held in Yolo Water & Power Company versus Industrial Accident Commission of California (168 P. 1146). An employer's foreman had full authority to hire whatever help he needed, and did hire men admitted to be employees of his employer, and also hired men and teams for a lump sum, and on at least one occasion hired a team separately. He also furnished his own team on some occasions, and the injured person at the time of his injury was driving the foreman's team. The foreman directed the drivers to exactly the same extent as other employees, and intended to engage the injured person as an employee of his employer, and the injured person, who had worked for the employer on numerous occasions, intended to work as usual as its employee. The foreman made no profit on the injured person's services as driver, the injured person being paid the usual wages for driving and the foreman retaining the amount usually paid for a team. It was held that the injured person was an employee of the general employer, and not an employee of the foreman, the contention that when the foreman obtained a team and a man together he stood in the position of a contractor being without merit.

Men of the Industry

Changes in Personnel and Position—Biographical Notes

A. L. Strickland has been appointed district manager of the Pacific Power & Light Company at Seaside, Ore., succeeding Harlow Moore, resigned.

Frank Carder has been appointed manager of the Oklahoma Gas & Electric Company, Norman (Okla.) division, succeeding W. P. Jones, resigned.

J. P. Pulliam, formerly with the Eastern Wisconsin Railway & Light Company, has been appointed general manager of the Wisconsin properties of the Wisconsin Securities Company.

W. D. Hodson, formerly superintendent of the Northern Ohio Traction & Light Company, has resigned to take an interest in the Imperial Electric Company of Akron, motor manufacturer.

C. C. Curtis, lighting superintendent of the El Paso (Tex.) Electric Company, has been appointed manager of the Cape Breton Electric Company, Ltd., succeeding E. L. Milliken, who was transferred.

G. A. De Haseth, formerly with the Tacoma Railway & Power Company, has been appointed manager of the Ponce (P. R.) Electric Company, succeeding P. M. Hatch, now in the Ordnance Department of the army.

C. R. Dillman, formerly with the Grand Rapids-Muskegon Power Company at Muskegon, Mich., has been placed in charge of the Akron (Ohio) Appliances salesroom of the Northern Ohio Traction & Light Company.

T. R. Steingoetager has been named business manager of the St. Clair County Gas & Electric Company, with headquarters at Belleville, Ill. He has been with the company since a boy and has served in late years as a traveling auditor and more recently as general auditor of the company at East St. Louis, Ill.

B. J. Caldwell, vice-president of the Caldwell Electric Corporation, Champaign, Ill., has been commissioned by the navy board to do electrical engineering work for the navy. Mr. Caldwell is a graduate of the college of engineering of the University of Illinois in the class of 1911 and has been electrical engineer for the Caldwell Electric Corporation since.

A. G. De Clercq has been appointed construction superintendent of the Commonwealth Edison Company to succeed J. H. Goehst, who before his death was the oldest employe in point of service with the Edison company. Mr. De Clercq's first work with the Commonwealth Edison Company began on May 6, 1899, soon after his return from Cuba with the Illinois Volunteers. It consisted of handling lamp renewals and doing work between times in the testing laboratory. In 1902 he took a leave of absence to enter the Michigan Agricultural College at Lansing. In 1903 he again entered the employ of the Commonwealth Edison Company and since that time has held many positions, including those of job foreman, division foreman, supervisor of station installation, division and assistant construction superintendent. He is at present the president of the Commonwealth Edison Section, N. E. L. A.

C. R. Phenecie, vice-president of the Wisconsin Service Company, has been appointed general manager of the Wisconsin Security Company and will take up his headquarters at Green Bay as soon as he has completed work on an auxiliary plant at Manitowoc.

H. W. Courville has been promoted from superintendent of power distribution of the Consumers' Power Company, Jackson, Mich., to general superintendent of distribution in the Flint District. Mr. Courville was appointed local manager of the Commonwealth Power Company at Jackson in 1912, having before that been connected with the Denver Gas & Electric Company and more recently with the Butte Electric & Power Company.

L. A. PETTIT, JR.

L. A. Pettit, Jr., who has been associated with the Albert Emanuel Company for the last nine years as general manager of this property and also as treasurer and secretary of its several companies, has severed active connection with the company to engage in the business of controlling and managing public utility properties. Mr. Pettit will remain a director in the following companies operated by the Albert Emanuel Company: Consolidated Utilities Company, Kansas Electric Utilities Company, Emporia, Kan.; Morris County Light & Power Company, Council Grove, Kan.; Southwestern Utilities Company, Alva, Okla.; Williamson (West Va.) Light & Power Company; Union City (Ind.) Electric Company; Sidney (Ohio) Electric Company; Coal District Power Company, Fort Smith, Ark., and Utilities Lighting Company, Albion, Pa. Mr. Pettit also intends to engage in consulting engineering work on utility rates, developments, reports, etc.

H. O. Clarke, Jr., commercial manager of the Houston Lighting & Power Company, has received an appointment from the government to assist the local aviation construction and field officers in an advisory capacity in problems concerning their electrical installations at the local army cantonment.

George H. Losey, assistant general superintendent and electrical engineer for the Indiana Railway & Light Company, Kokomo, Ind., has resigned to become connected with the Great American Refining Company at Tulsa, Okla. Mr. Losey has been with the Kokomo company for the last ten years in various engineering capacities, starting in in the meter department and advancing through a line of promotions. He is a graduate of the electrical engineering course of Purdue University.

C. E. Bennett will be assistant to Charles G. Adsit, consulting engineer of the Georgia Railway & Power Company, Atlanta, Ga., after Feb. 15. Mr. Bennett, who a number of years ago was connected with the Georgia company, has been associated with Curtis A. Mees, consulting engineer of Charlotte, N. C., since last summer. In the summer of 1915 Mr. Bennett resigned the position of electrical engineer with the Northern Contracting Company and the Georgia Railway & Power Company to become associated with Hugh L. Thompson, consulting engineer of Waterbury, Conn. Prior to that time he was electrical engineer with L. B. Stillwell, New York City, and later with Charles O. Lenz of New York City, having been his principal assistant on the Tallulah Falls development of Georgia. He was also connected with the J. G. White Company of New York City. In the summer of 1917 he resigned as mechanical and electrical engineer for Mr. Thompson to become associated with Mr. Mees, as stated above.

Obituary

William Temple Emmet, a member of the Public Service Commission for the Second District of New York since March, 1914, died on Feb. 4 at the age of forty-nine years.

Judge R. S. Taylor of Fort Wayne, Ind., who some years ago was one of the leading patent attorneys of the country, particularly in the electrical field, died at his home on Jan. 28 at the age of seventy-nine. One of his earlier achievements in the patent field was in connection with a suit brought by the old Bush company of Cleveland for infringements on arc-lamp patents. Judge Taylor's victory in this case established the right of all companies to continue the manufacture of arc lamps. Later, as chief counsel for the independent telephone interests established after the old Bell patents had expired in 1893 against the Bell system, he succeeded in obtaining a decision granting the right to the independent companies to continue the use of the transmitter.

TRADE & MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies— Notes on Industrial Activities and Business Methods

OCTOBER EXPORTS OF ELECTRICAL PRODUCTS

Total Foreign Trade of That Month Officially Valued at $4,151,635, as Against a Total Value of $4,048,080 in October, 1916

Exports of electrical goods, apparatus, etc., for the month of October, 1917, were about on a level with those of the same month in 1916, namely, $4,151,635 as against $4,048,080. Battery exports in October last were nearly double those for October, 1916; dynamos and generators, however, indicate a marked falling off, as do insulated wire and cables, while, on the other hand, exports of metal-filament lamps were more than double.

For the ten months ended October, 1917, there was an increase in value of more than $11,000,000 over the corresponding period a year previous. Every item in the list, which was compiled by the Bureau of Foreign and Domestic Commerce of the Department of Commerce, represents a larger volume than the same period in the previous year. Insulated wire and cables showed an increase of $2,000,000; interior wiring supplies, including fixtures, nearly $900,000; metal-filament lamps more than $1,000,000, motors $2,000,000, and transformers $300,000. The official figures follow:

Articles	October 1916	October 1917	Ten Months Ended October 1916	Ten Months Ended October 1917
Batteries	$173,734	$275,721	$1,504,788	$2,843,768
Carbons	.....	127,271	.....	*463,451
Dynamos or generators	249,281	196,146	1,379,153	1,914,151
Fans	13,949	29,276	269,180	516,606
Heating and cooking apparatus	.....	63,840	.....	*149,236
Insulated wire and cables	575,024	306,713	3,587,342	5,797,767
Interior wiring supplies including fixtures	89,214	100,345	735,838	1,030,109
Arc lamps	644	737	13,590	14,152
Carbon-filament lamps	22,417	18,023	93,987	156,340
Metal-filament lamps	103,655	240,686	1,170,292	2,254,661
Magnetos, spark plugs, etc.	.....	283,272	.....	*995,617
Meters and measuring instruments	80,895	80,689	705,137	888,870
Motors	528,666	546,255	3,995,668	5,132,542
Rheostats and controllers	.....	23,343	.....	*61,188
Switches and accessories	.....	82,782	.....	*549,679
Telegraph apparatus, including wireless	18,366	16,609	139,127	486,960
Telephones	105,146	210,276	1,322,939	1,705,521
Transformers	90,367	224,975	892,302	1,263,625
All other	1,996,722	1,324,676	15,266,360	18,153,343
Total	$4,048,080	$4,151,635	$31,075,703	$44,377,586

*Figures cover period beginning July 1.

SPECIFICATIONS FOR PACKING FOR EXPORT

Suggested Guides for Machinery Supplies and Equipment on Orders Issued by the General Engineer Depot

Recognizing the necessity for informing American manufacturers of the best practice for export packing, the General Engineer Depot, Washington, D. C., suggests the following specifications as guides for packing machinery, supplies and equipment for export or orders issued by its department:

"1. All merchandise must be protected by substantial boxing and must be securely packed therein. Export shipping conditions involve much rougher handling than is usually understood.

"2. All packing should be as light in weight as possible and cubic contents kept to a minimum in order to economize shipping space, but the paramount consideration must always be safe handling. Brittle pine crates of ½-in. board are worthless.

"3. Packages over 1000 lb. or less than 200 lb. are to be avoided when practicable.

"4. Each case or crate should be firmly bound with strap or band iron. Straps should be not less than 1 in. wide and No. 18 gage. Ends should overlap at least 6 in.

"5. All lumber used in boxing and packing to be strictly sound and of such dimensions as to insure full protection under rough handling. Under no circumstances should outside boxing be less than 13/16 in. thick.

"6. Packages over 300 lb. should be packed in not less than 2-in. stock, additional straps and binding to be used at every 2½ in. for boxes exceeding 3 ft. in length.

"7. Boxes 600 lb. in weight, or over, shall have 4-in. by 4-in. skids, top and bottom of box, securely bolted together with ⅝-in. diameter bolts, and these bolts, wherever possible, should extend entirely through box. To prevent shifting, ends of box must be securely braced inside.

"8. Use yellow pine, gum, white pine, spruce and hemlock lumber surfaced on one or more sides. This gives a desirable uniformity of thickness and makes easy stenciling on more than one face of the package.

"9. Use cement-coated or barbed-wire nails—eight-penny and ten-penny. This is important to make the nails hold. Not less than two in end of any board and not over 4 in. apart in wide boards (6-in. boards, three nails).

"10. Use corner posts in all packages.

"11. Machinery itself should be covered with waterproofing paper or oilcloth to prevent damage from moisture. Machinery should be thoroughly slushed with suitable protective compound. All loose or detached parts should be firmly and securely fixed to prevent dislodgment during transit. All finished surfaces to be amply protected against injury from salt air and water.

"12. Packages containing machinery or parts should be securely blocked in the case or crate to prevent movement.

"13. Electrical and mechanical apparatus to be solidly packed, in excelsior, straw, salt hay or other filler, in a solid box with paneled ends, securely nailed, and then reinforced with ⅞-in. by 3-in. battens around the sides at the ends, with 1-in. by No. 18-in. gage strap iron all the way around the battens, ends lapping at least 6 in.

"14. Hardware, nails, bolts, etc., because of their weight, should be packed in small cases or kegs.

"15. Materials such as glassware, tools, lamps, instruments, powder and acids shall be shipped in boxes, the thickness of stock to be determined by the weight or cubical capacity.

"16. Tools, instruments or any articles subject to damage by moisture shall be well wrapped in waterproof paper and boxes thoroughly lined with waterproof paper before being packed.

"17. Cylindrical articles, such as tanks, boilers, etc., shall be shipped in cradles made of heavy timbers, the articles to be securely bolted to cradles or skids.

"18. Oils, paints and liquids shall be shipped in 50-gal. barrels or steel drums of not less than No. 16 gage or in heavy tin containers which should be hermetically sealed and securely packed in boxes.

"19. On heavy boxes sling marks are to be plainly indicated on outside at the proper place, reinforcement being provided to insure against damage to case.

"20. All wide side pieces of flat packages should be prevented from splitting by cross-pieces nailed thereto—one in the middle for 6 ft. and two for sides over 6 ft.; band iron or corner clips to top and bottom should connect at these cross-pieces.

"21. If new packing is tried, test boxes and crates by forcibly pushing each over the end twice. The package is then dropped from a platform 3 ft. or 4 ft. high. The package must not be broken to any extent by this test.

"22. Projecting portions of heavy castings having narrow necks must be taken off, as they will break off by jarring.

"23. Gray-iron extended parts must be kept ½ in. to 1 in. away from covering, as the spring of boards will cause breakage.

"24. Two heavy cast pieces must not rest together, but must be cushioned or separated by wood brace or block.

"25. In packing machines which are knocked down it is desirable to indicate, "Open on this side."

"26. Heavy items must be firmly bolted to skids or flooring; nothing shall be hung from sides of box. Unoccupied space in packing boxes must be thoroughly braced.

"27. Packages must sometimes be proportioned to facilities for handling at port.

"28. In marking packages use black waterproof marking or stencil paint.

"29. Put the following marks, in rectangle, on each separate box, crate, bundle or piece, unless otherwise instructed.

D. Req.....	F. Req.....
Order No.....	Pkg. No.....

"In addition to all marks hereinbefore specified, there is to appear on each package a synopsis of the contents of same, cubic contents, gross weight and by whom shipped.

"30. Packing lists must be made out correctly and in detail with all information called for. Merchandise must be described in specific terms. Such designations as 'Provisions,' 'Groceries,' 'Canned Goods,' 'Hardware,' 'Machinery,' or any other general terms, must not be used."

METAL MARKET SITUATION

Speculation Rife on the Future of Copper—Prices Reported Cut on Less than Car Lots

Discussion goes on whether the government price of 23.50 cents is equitable to both producers and industrial consumers of copper. Speculation runs along lines as to whether there is sufficient of the metal produced to satisfy governmental and commercial purposes. It is evident that the mining interests are disappointed in not obtaining a better price from the War Industries Board and are therefore still "bearing" the market when possible. On the other hand, there seems to be plenty of copper available. Possibly the official price is being observed in transactions covering carload lots, but an authority states that there is a constant cutting of the government figure of 24.67½ cents for less than car lots.

The other metals are featureless, the same prices prevailing as last week, with tin scarce and none worth mentioning arriving either from China or the Straits.

NEW YORK METAL MARKET PRICES

	Jan. 28	Feb. 4
Copper:	£ s d	£ s d
London, standard spot.....	110 0 0	110 0 0
Prime Lake	Govt. price 23.50	Govt. price 23.50
Electrolytic	Govt. price 23.50	Govt. price 23.50
Casting	Govt. price 23.50	Govt. price 23.50
Wire base	27.00	27.00
Lead, trust price	6.75	6.75
Nickel, ingot	50.00	50.00
Sheet zinc, f.o.b. smelter.....	19.00	19.00
Spelter, spot	7.82½ to 7.92½	7.92½
Tin, Straits	85.00*	85.00*
Aluminum, 98 to 99 per cent...	34.00 to 36.00	34.00 to 36.00

OLD METALS

Heavy copper and wire.....	21.50 to 22.00	21.50 to 22.00
Brass, heavy	13.75 to 14.50	13.75 to 15.00
Brass, light	10.00 to 10.50	10.00 to 10.50
Lead, heavy	6.20 to 6.25	6.00 to 6.25
Zinc, old scrap.....	5.00 to 5.50	5.00 to 5.50

*Nominal.

THE WEEK
IN TRADE

WITH government priority orders practically dominating every industry, the electrical goods line also feels their far-reaching effects. Manufacturers, distributers and jobbers are reported as having their customary methods of doing business greatly disturbed, in production and distribution, by the transportation tie-ups, embargoes, fuelless Mondays and other restrictions of a minor nature. Yet, in the face of these drawbacks, a steady demand for electrical goods of every description is in evidence. Trading, both wholesale and retail, is quite satisfactory, and in some sections heavier than ever. As yet no special difficulty is being encountered in obtaining goods beyond being subject to the embarrassing delivery delays.

A wider and more active market is commented upon for motors, circuit breakers, standard wiring devices, insulating and pole-line material, conduit, heating and general household appliances, vacuum cleaners, etc. Sellers, however, are rather reluctant to engage themselves very far ahead, even at the prevailing high prices. Advances on a few lines were lately made, and a higher level seems almost assured for electrical glassware of every description. Curtailment of iron and steel production in the last few weeks may also cause a more or less acute situation with the manufacturers of finished electrical merchandise wholly or in part of these metals.

Collections are variously stated as excellent, less prompt and fair, due to differing conditions. Credits, however, are held along firm lines.

NEW YORK

With large government contracts in the market for electrical goods, jobbers of the heaviest caliber are not inclined to jeopardize stock by bidding. It is figured that on some articles specified the quantities are so enormous that only manufacturers can safely handle them. Under these circumstances the plants would be completely tied up for months ahead. The first quantity of what is spoken of as the largest requirement on record, the details of which appeared on page 173 of the ELECTRICAL WORLD of Jan. 19, was urgently needed on or before Feb. 1.

Complaints regarding scarcity of labor for sufficient factory forces are heard, as well as of the restrictions placed on deliveries by the inadequate transportation facilities. Prices are generally mentioned as being at peak, but there are rumors afloat of still further advances in some lines.

Collections are from fair to good, and extensions of credits are being closely viséd.

PORCELAIN.—The supply of porcelain goods is reported by jobbers only fair. The market has been strained, it is said, by government requisitions for 3,200,000 unglazed cleats, 24,000 knobs, 480,000 rosettes and 769,600 tubes.

FUSES.—Manufacturers are distributing literature descriptive of their goods and also furnishing the details of their sales policy for the year. No price changes have as yet been announced. One manufacturer, who expected to be in the market with a refillable fuse by now, states that on account of the difficulty and delay in making up tools for its production it will be fully six months before the line will be announced. Sales are said to be in good volume, one concern reporting that fuses are selling heavier than ever before. Some dealers complain that discounts on renewable fuses are too low.

SMALL MOTORS.—Deliveries are improving and can be made in four or five weeks if transportation is available.

FANS.—A representative fan manufacturer remarked this week that the distributers on his list had about all signed up for their 1918 requirements. The contracts so

far filed represented about 75 per cent of last year's commitments, he said, but as 1917 was an exceptional fan year, 1918's orders were, therefore, about normal. Another producer of equal prominence declared fans were selling in greater quantities for 1918 and that his company's contracts demonstrated this to be a fact.

CONDUIT.—Up to inch conduit the supply in this market is quoted as fair, and one jobber who has two cars in stock is referred to as being in a fortunate position. Conduit about one inch in diameter is difficult to obtain.

CIRCUIT BREAKERS.—The demand for large-capacity circuit breakers is reported as unusually heavy. Deliveries are from eight to ten weeks in arrears, solely dependent upon the release of cars. No advance in price has been made, a manufacturer of a diversified line says, since Dec. 1 last, when the list was only equalized on certain sizes.

LIGHTNING ARRESTERS.—A sharp call for lightning arresters was noted in the last few weeks. The government recently placed an order for 6000. Prices are stable, with shipments from stock.

HEATING APPLIANCES.—One local distributer did a business in January over twice that done in January, 1916. To a considerable extent this was due to sales of heaters and warming pads. The government is in the market for around $100,000 of electric heaters and foot warmers. A large part of this order will be for stock.

CHICAGO

Since the first of the year the trade is getting more squarely on its feet. It sees the changed market conditions more clearly. Efforts that were formerly occupied in the building trades field are already shifted to the more profitable industrial plant and resale merchandise business. While the general wiring business is off, the retail trade was never better.

The leading group of electric shops in the city reports that its sales were better month by month in 1917 than in 1916, with the exception of July. The reason July fell below the previous year's record was not that July, 1917, was bad, but that July, 1916, was an exceptionally good fan month. Sales for January, 1918, were better than those of January, 1917, in spite of the fact that January, 1917, was a surprisingly good month.

CONDUIT. — In spite of the very low showing of electrical permits for the last few weeks the demand for conduit very greatly exceeds the supply. This is due probably to the fact that many of the industrial buyers of pipe are outside the city limits. It is said that while this week has been a breathing spell in the conduit field certain large industrial plants are known to be buying conduit in advance of requirements and putting it in stock for future use.

LAMPS.—The price increase has not affected the volume of lamp business. In making the increase of 10 per cent some unusual retail prices, such as 27.93 cents, were arrived at, but these details have been straightened out.

VACUUM CLEANERS.—The manufacturers are finding it easy to market all the machines they can make from the material they can secure. One cleaner has advanced $10 in retail price and other increases are expected.

BOSTON

A perceptible falling off in trade is noted among jobbers and retailers, as was the case last week, but no permanent curtailment of business appears at all likely. From various quarters it is reported that the Monday shutdowns, which it is hoped will be eliminated throughout the East after this week, have had a bad effect on buying.

Contractors and dealers are on the whole overstocked with supplies at present. Collections continue rather slow, excepting from the larger central stations and from the mills. It is doubtful whether credits will show much improvement for the next month or so unless the smaller contractors get a chance to work off more of their stocks and to carry through construction work of a more diversified character than is now on their books. Deliveries are very unsatisfactory, owing to railroad congestion and embargoes, but some manufacturers are beginning to improve their shipment dates through stock accumulation, notably in representative types of small alternating-current motors.

A 10 per cent advance in single-phase motors was put into effect in January by the Wagner Company, one of the last manufacturers to establish a recent increase. Appliance sales reflect a fairly healthy market condition. The opinion is advanced in some quarters that further price increases in electrical apparatus and supplies are quite within the bounds of probability during the next few months, though it is not expected that radical advances will take place at any one time. On the whole, the labor situation is reasonably quiet.

There is some hope of better electric railway conditions in Massachusetts at the present legislative session, ultimately leading to more general buying of supplies and equipment than has been practised for a long time.

MOTORS.—Local stocks are rather depleted, and their restoration depends to a very large extent upon the improvement possible in the railroad situation. Prices are firm, barring an advance noted above during the last month. Factory stocks of smaller motors are showing some improvement, but large units are still very scarce.

RADIATORS.—Sustained cold weather, high fuel cost and scarcity of coal are producing an unprecedented volume of business.

CONDUIT.—Prices show little change and stocks are about the same as last week. Until transportation conditions improve deliveries will continue very uncertain. Contractors are reported heavily stocked with the smaller fittings.

POLE-LINE HARDWARE.—Jobbers report this material to be very scarce. Deliveries are anything but satisfactory, on account of the railroad situation. One jobber looks for further price increases this spring.

LAMPS.—There is a prospect that orders of larger volume will be accepted after April 1 for bulk deliveries.

TELEGRAPH AND TELEPHONE MATERIAL.—Substantial sales of this equipment are being made for foreign service. Radio apparatus is in active demand for government use. There is a shortage of 2000 ordinary telegraph keys for New England service. Interior wire for telegraph work is easily obtained and is the first material to arrive on many plant construction jobs.

STORAGE BATTERIES.—An enormous volume of government business is being handled. Inquiries are very active for industrial truck batteries, and a recent price advance in battery equipment increased the corresponding truck price only 2 or 3 per cent. Much interest in trucks is shown by navy yards and arsenals.

ATLANTA

Dr. Garfield's latest interpretation of his fuel order as applied to industries served from hydroelectric sources has tended to clarify a very confusing situation in the Southeast. Almost all industrials using this form of energy operated through the five-day period, but a later announcement to the effect that all plants operating by hydroelectric power "are requested to shut down on Mondays" created a perplexing situation, and local fuel administrators for each state issued orders on the basis of their own construction, the outcome being that a number of plants continued to run while others shut down. From now on the various plants fortunate enough to have hydroelectric connections, and which can operate with sufficient fuel to keep pipes from freezing, can do so without feeling that their patriotism is questioned.

The rainfall has been abundant during this week and most of the streams have become swollen, which will materially help the hydroelectric companies, especially when they close down all auxiliary steam plants on Mondays. Generally speaking, the industries of this section are loaded with orders, principally for government account, and while the stoppage of work in some instances brought about by the fuel decree, in addition to effects of bad weather, curtailed

production and restricted trading in certain areas, a marked improvement is noted in the fuel situation and a more cheerful feeling in outlying districts.

The Brunswick (Ga.) Chamber of Commerce has been notified by a representative of the Emergency Fleet Corporation that at least 1000 houses will have to be erected at Brunswick within the next sixty days. It is also reported that these houses will be wired for electric lights. In this event a market will be opened for standard wiring devices. There is a noticeable falling off in the demand for heavy apparatus of late. This holds true as well with heavier cables, which have shown little activity except in scattered and isolated cases.

POLE AND LINE MATERIAL.—The demand for this line has been strengthened by telephone and telegraph requirements. A slight decrease in the call is noted from central stations. Hardware remains very active in the face of a 10 per cent increase in price in the last two weeks. Shipment promises are better and deliveries show marked improvement.

CROSS-ARMS.—An advance of 10 per cent was made Jan. 1, 1918. The heavy draft on this class of wood by the government for aeroplane work has, for the time, sidetracked and delayed shipments for normal industrial work, and the deliveries to this section have been slowed up materially.

INSULATING MATERIALS.—There has been a notable increase in the call for varnished cambric and mica insulators in the Southeast lately. Various repair shops report a large volume of work on hand. On the whole, deliveries are very good on insulation material, with the exception of a few special requirements.

SECOND-HAND EQUIPMENT.—Although a large quantity of this class of apparatus is being traded in, repaired and put in good shape, the pressure has lessened to some extent, and there is a tendency in certain sections to wait on shipments of new apparatus when other work cannot be completed in an equivalent time.

SEATTLE

Jobbers and dealers as a whole report that the volume of business in January exceeded by far that for any previous January in the history of the Northwest. Sales of household appliances, particularly of sewing and washing machines, equaled sales of December last year, which were large on account of the Christmas demand. Jobbers state that the sale of sewing machines is increasing daily and the Christmas record for washing machines is being sustained. Other household appliances are selling well, and the sale of flatirons is expected to increase materially within the next two months.

January did not experience the usual slow-up, which was a source of surprise and satisfaction. The present activity is expected to continue and increase throughout the year. The week's industrial business is featured by the awarding of several large ship contracts to the Northwest yards. Contracts have been awarded in Seattle for twenty-two cargo steamships, fourteen 8800-ton steel ships, costing $20,000,000, and eight 4000-ton wooden vessels, costing $7,000,000. These contracts bring the total number of ships building in Seattle to 135, the majority of which are direct federal contracts, and about three-fifths will be constructed and delivered during 1918. Authorities state that the shipbuilding industry in the Northwest is placed beyond the realm of uncertainty for the next two years by the substantial business already signed by various yards.

Owing to the recent freight embargo in the East box cars cannot be obtained for shipping conduit pipe, etc., to Pacific Coast jobbers who supply shipbuilding corporations. If the situation is not relieved or improved materially within two or three weeks, it may prove very serious. However, local jobbers believe that the matter will be adjusted before the situation becomes acute.

A new record for January building in Seattle was set last month, activity being confined almost exclusively to residences, factories and workshops. Permits for residences alone were issued to the value of over $300,000. From present indications the residence building records will be shattered in Seattle during the next two months. Residence building in Tacoma is progressing at a greater rate than at any time in the last five years. January broke all records. The high prices of materials and labor and the scarcity of both continue to restrict building in Portland, although a residence building boom is expected shortly. The proposed construction of numerous grain elevators in eastern Washington and Oregon will mean much to jobbers in sales of motors and other electrical equipment. During the past month the announcement of construction of at least fifteen, ranging in cost from $25,000 to $35,000, has been made.

Collections during January were fair. Government collections, particularly from the navy are slow. Very few new credits were placed, and applications are being scrutinized closely.

LINE MATERIAL.—Telephone equipment, including pole-line material, wire, cross-arms, insulators, etc., experienced a very satisfactory movement in the last two weeks. Several lucrative orders were placed for repairs and needed improvements. Wire stocks are ample, but there is a shortage of cross-arms and poles.

DYNAMOS AND TRANSFORMERS. — Motors, generators and transformers show a very satisfactory volume of sales. A Portland jobber landed an order of considerable size last week, and one or more large orders are in prospect.

SAN FRANCISCO

The foremost topic in discussing California business conditions and prospects just now is the drought. There has been some relief, but the situation is still very serious. In the central valleys, where the seasonal precipitation at this time averages 14 in., only 2½ in. has fallen this year, and even if the average rainfall of 9 in. occurs from now on, much of the unirrigated land will not produce. The land under irrigation systems will also suffer in that the supply of stored water will be very low. In the mountains, where the snowfall is usually more than 20 ft. by this time, only 2 ft. of snow has fallen, and the water stored for hydroelectric power will this year be very much below normal.

These conditions have affected the electrical trade already in that dealers are not placing the usual orders. However, that this is not the only angle from which to view California conditions is shown by the statement from one of San Francisco's large electrical jobbing firms that the last month has been the best in volume of trade for several years. Moreover, a further analysis of that trade indicates that it consisted of purchases whose average value was less than normal. This refutes the claim that the only heavy business comes from large government or industrial orders.

CREDITS AND COLLECTIONS.—Collections are exceptionally good for this time of year and apparently are not suffering under war conditions. Credits are being extended about as usual.

WIRE.—Stocks are in poor shape and deliveries slow. Little improvement can be hoped for.

SAFETY SWITCHES.—Stocks are greatly improved in this line, partly because of the change in recent months from building to industrial construction.

STORAGE BATTERIES.—The sales in January in this line, one manufacturer reports, were about 25 per cent more than in the corresponding month a year ago. The industrial and gasoline-engine manufacturing fields have been very active, supplementing the steady demand for automobiles.

MOTORS.—The irrigation demand continues unusually heavy, and manufacturers are handling the situation very well, being materially aided in this by the Priority Board. It is noted that the demand for transformers from agricultural districts has not been so heavy as would be indicated by the motor business, but this is largely because service is supplied by power companies at voltage suitable for customers' motors.

WIRELESS SUPPLIES.—An even greater demand than before the war is noted in some lines of wireless specialties. Buzzer sets for government schools and equipment for instruction generally have gained large volume.

Current Prices of Electrical Supplies

New York and Chicago Quotations

THE prices quoted are those prevailing in standard packages of specified lots on apparatus and appliances in Eastern and Middle West markets at the beginning of business on Monday of this week. They are in all cases the net prices or prices subject to discounts from standard lists of contractors, central stations, dealers and others engaged in the resale of such goods.

Prices in Southern and other nearby markets will rule about the same as those in the Middle West, although slight modifications to cover increased freight and local demands should be expected. In the Far West and on the Pacific Coast the prevailing prices are naturally higher, covering as they must increased freight and the necessity of larger stocks with increased interest and warehouse charges on account of the distances from sources of supply, infrequent turnover of stock and uncertainty as to delivery of goods in transit. Moreover, the Far West presents a wide variation in demand due to a small population spread over a wide area in agricultural and mining communities, as contrasted with the denser population of the East and Middle West, their nearness to the sources of supply, the more frequent turnover in stocks and the constant demands which arise in industrial centers. Price variations may be due to difference in grade of products of different manufacturers, to local conditions, or to both.

ARMORED CONDUCTORS, FLEXIBLE STEEL

Single-Conductor

B. & S. Size	List per 1000 Ft.
No. 14 solid	$61.00
No. 12 solid	71.00
No. 10 solid	90.00
No. 8 solid	106.00
No. 6 solid	145.00
No. 10 stranded	95.00
No. 8 stranded	115.00
No. 6 stranded	160.00
No. 4 stranded	205.00
No. 2 stranded	266.00
No. 1 stranded	315.00

Twin-Conductor

No. 14 solid	104.00
No. 12 solid	135.00
No. 10 solid	185.00
No. 8 stranded	235.00
No. 6 stranded	370.00
No. 4 stranded	575.00

NET PRICE AND DISCOUNT PER 1000 FT.—NEW YORK

Single-Conductor

	No. 14 Solid
Less than coil	List to $61.00
Coil to 1000 ft	10% to 59.17
	No. 12 Solid
Less than coil	List to $71.00
Coil to 1000 ft	—10% to 68.87

Twin-Conductor

	No. 14 Solid
Less than coil	List to $105.00
Coil to 1000 ft	$70.00 to 10%
	No. 12 Solid
Less than coil	10% to $135
Coil to 1000 ft	10% to $130.95

DISCOUNT—CHICAGO

Single-Conductor

	No. 14 Solid
Less than coil	+10%
Coil to 1000 ft	—10%
	No. 12 Solid
Less than coil	+10%
Coil to 1000 ft	—10%

Twin-Conductor

	No. 14 Solid
Less than coil	+10%
Coil to 1000 ft	—10%
	No. 12 Solid
Less than coil	+10%
Coil to 1000 ft	—10%

ATTACHMENT PLUGS

List ranges from $0.22 to $0.30 each. Standard packages from 100 to 250.

DISCOUNT—NEW YORK

Less than 1/5 std. pkg	10%
1/5 to std. pkg	20%
Std. pkg.	34%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg	+20% to 12%
1/5 to std. pkg	20% to list
Std. pkg.	28% to 44%

BATTERIES, DRY

NEW YORK

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.31	.32
Barrel lots	.28 to .285	.29 to .295

CHICAGO

Each Net	No. 6 Regular	No. 6 Ignitor
Less than 12	$0.40	$0.40
12 to 50	.35	.35
50 to barrel	.3175	.3275
Barrel lots	.2875	.2975

CONDUIT, METALLIC FLEXIBLE

Size, In.	Ft. per Coil	List, Per 100 Ft.
5/16	250	$5.00
3/8	250	7.50
1/2	100	10.00
3/4	50	13.00
1	50	21.00
1 1/4	50	26.00
1 1/2	25–50	35.00
2	25–50	45.00
2 1/2	25–50	52.00

NET PER 1000 FT.—NEW YORK

	Less Than Coil	Coil to 1000 Ft.
3/8-in. s. stp.	$75.00	—15% to $69.75
3/8-in. d. stp.	+10% to 75.00	List to 72.00
1/2-in. s. stp.	List to 100.00	—15% to 93.00
1/2-in. d. stp.	+10% to 100.00	List to 96.00

NET PER 1000 FT.—CHICAGO

	Less Than Coil	Coil to 1000 Ft.
3/8-in. single strip	$75.00	$63.75
3/8-in. double strip	78.75	71.25
1/2-in. single strip	100.00	85.00
1/2-in. double strip	105.00	95.00

CONDUIT, NON-METALLIC FLEXIBLE

Size, In.	List Per Foot	Size, In.	List Per Foot
7/32	$0.05 1/2	1	$0.25
1/4	.06	1 1/4	.33
3/8	.09	1 1/2	.40
1/2	.12	1 3/4	.47
5/8	.15	2	.55
3/4	.18	2 1/4	.65

NET PER 1000 FT.—NEW YORK

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$25.00-$55.00	$20.50-$24.50	$20.00-$21.50
1/4-in.—	$28.00-$60.00	$22.50-$27.00	$20.00-$23.50

NET PER 1000 FT.—CHICAGO

	Less Than $15 List	$15 to $60 List	$60 to $150 List
7/32-in.	$36.00-$55.00	$25.00-$37.50	$22.50-$24.75
1/4-in.—	$40.00-$60.00	$27.00-$30.00	$25.00-$27.00

CONDUIT, COUPLINGS AND ELBOWS, RIGID IRON

Card No. 38

Size, In.	Conduit, List per Foot	Couplings, List	Elbows, List
1/4	$0.08 1/2	$0.05	$0.19
3/8	.08 1/2	.06	.19
1/2	.08 1/2	.07	.19
3/4	.11 1/2	.10	.25
1	.17	.13	.37
1 1/4	.23	.17	.45
1 1/2	.27 1/2	.21	.50
2	.37	.28	1.10
2 1/2	.58 1/2	.40	1.80
3	.76 1/2	.60	4.80

DISCOUNT—NEW YORK

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	4% to 6%	7% to 9%
2500 to 5000 lb.	6% to 8%	9% to 11%

(For galvanized deduct six points from above discounts.)

DISCOUNT—CHICAGO

	1/4 in. to 1/2 in.	3/4 in. to 3 in.
Less than 2500 lb.	1.3% to 4.7%	4.3% to 7.7%
2500-5000 lb.	3.3% to 6.7%	6.3% to 9.9%

(For galvanized deduct six points from above discounts.)

FLATIRONS

NEW YORK

List price	$5.00 to $6.00
Discount	30%

CHICAGO

List	$5.00
Discount	25% to 30%

FUSES, INCLOSED

250-Volt	Std. Pkg.	List
3-amp. to 30-amp.	100	$0.25
35-amp. to 60-amp.	100	.35
65-amp. to 100-amp.	50	.90
110-amp. to 200-amp.	25	2.00
225-amp. to 400-amp.	25	3.60
450-amp. to 600-amp.	10	5.50
600-Volt		
3-amp. to 30-amp.	100	$0.40
35-amp. to 60-amp.	100	.60
65-amp. to 100-amp.	50	1.50
110-amp. to 200-amp.	25	2.50
225-amp. to 400-amp.	25	5.50
450-amp. to 600-amp.	10	8.00

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	28%
1/5 to std. pkg.	38%

FUSE PLUGS

3-Amp. to 30-Amp.

NEW YORK

	Per 100 Net
Less than 1/5 std. pkg.	$5.00 to $5.75
1/5 to std. pkg.	4.50

Standard package, 500. List, each, $0.07.

CHICAGO

	Per 100 Net
Less than 1/5 std. pkg.	$6.25
1/5 to std. pkg.	5.25

Standard package, 500. List, each, $0.07.

LAMPS, MAZDA

105 to 125 Volts

Regular, clear:	Std. Pkg.	List, Each
10 to 40-watt—B	100	$0.30
60-watt—B	100	.35
100-watt—B	24	.70
75-watt—C	50	.70
100-watt—C	24	1.10
200-watt—C	24	2.20
300-watt—C	24	3.25
Round bulbs, 3½ in., frosted:		
15-watt—G 25	50	.53
25-watt—G 25	50	.55
40-watt—G 25	50	.55
Round bulbs, 3¾ in., frosted:		
60-watt—G 30	24	.77
Round bulbs, 4⅜ in., frosted:		
100-watt—G 35	24	1.10

DISCOUNT—NEW YORK

Less than std. pkg.	Net
Std. pkg.	10%

DISCOUNT—CHICAGO

Less than std. pkg.	Net
Std. pkg.	10%

LAMP CORD

Cotton-Covered, Type C, No. 18

NEW YORK

	Per 1000 Ft. Net
Less than coil (250 ft.)	$24.90 to $31.00
Coil to 1000 ft.	22.72 to 27.90

CHICAGO

	Per 1000 Ft. Net
Less than coil (250 ft.)	$30.00 to $35.60
Coil to 1000 ft.	22.30 to 26.70

LAMP GUARDS, WIRE

Standard packages from 50 to 150.

NEW YORK

Net per 100	$20.00 to $29.00

CHICAGO

Net per 100	$19.25 to $25.75

OUTLET BOXES

Nos.	List, per 100
101—A, A1½, 4 S.C., 6200, 320	$30.00
102—B.A., 6200 S.E., 300, AX, 1½, 4 S.	30.00
103—C.A., 9, 4R, B 1½	25.00
106—F.A., 7, C.S. 1½, 3 R.	20.00

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $10.00 list	25%-37%	20%-32%
$10.00 to $50.00 list	42%-45%	37%-40%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $10.00 list	40%	35%
$10.00 to $50.00 list	50%	45%

PIPE FITTINGS

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	10%
1/5 to std. pkg.	20%
Std. pkg.	30%

PORCELAIN CLEATS—UNGLAZED

2 and 3 Wire

NEW YORK

	Per 1000 Net
Less than 1/5 std. pkg.	$20.00 to $38.00
1/5 to std. pkg.	19.00 to 26.00

Standard package, 2200. List per 1000, $20.

CHICAGO

	Per 1000 Net
Less than 1/5 std. pkg.	$15.80
1/5 to std. pkg.	14.80

Standard package, 2200. List per 1000, $20.

PORCELAIN KNOBS

NEW YORK

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000 5½ N. C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg.	$27.50 to $29.00	$30.75
1/5 to std. pkg.	15.60 to 20.75	24.20

CHICAGO

Per 1000 Net Std. Pkg. 3500 Std. Pkg. 4000 5½ N.C.—Solid Nail-it—N.C.

Less than 1/5 std. pkg.	$11.85	$30.75
1/5 to std. pkg.	11.10	24.20

SOCKETS AND RECEPTACLES

	Std. Pkg.	List
⅛-in. cap key and push sockets	500	$0.33
⅛-in. cap keyless socket	500	.30
⅛-in. cap pull socket	250	.60

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	Net to $23.00
1/5 to std. pkg.	20% to 21.00

NET PER 100—CHICAGO

Less than 1/5 std. pkg.	$25.00 to $45.00
1/5 std. pkg.	23.00 to 42.00

SWITCHES, KNIFE

250-Volt, Front Connections, No Fuse

High Grade:	
30-amp. S. P. S. T.	$0.80
60-amp. S. P. S. T.	1.20
100-amp. S. P. S. T.	2.25
200-amp. S. P. S. T.	3.48
300-amp. S. P. S. T.	5.34
30-amp. D. P. S. T.	1.20
60-amp. D. P. S. T.	1.78
100-amp. D. P. S. T.	3.38
200-amp. D. P. S. T.	5.20
300-amp. D. P. S. T.	8.00
30-amp. 3 P. S. T.	1.80
60-amp. 3 P. S. T.	2.68
100-amp. 3 P. S. T.	5.08
200-amp. 3 P. S. T.	7.80
300-amp. 3 P. S. T.	12.00
Low Grade:	
30-amp. S. P. S. T.	0.42
60-amp. S. P. S. T.	0.74
100-amp. S. P. S. T.	1.50
200-amp. S. P. S. T.	2.70
30-amp. D. P. S. T.	0.68
60-amp. D. P. S. T.	1.22
100-amp. D. P. S. T.	2.50
200-amp. D. P. S. T.	4.50
30-amp. 3 P. S. T.	1.02
60-amp. 3 P. S. T.	1.84
100-amp. 3 P. S. T.	3.76
200-amp. 3 P. S. T.	6.76

DISCOUNT—NEW YORK

	High Grade
Less than $10 list	List to + 5%
$10 to $25 list	11%
$25 to $50 net	14% to 15%
	Low Grade
Less than $10 list	5% to 10%
$10 to $25 list	16%
$25 to $50 list	24% to 25%

DISCOUNT—CHICAGO

	High Grade
Less than $10 list	+5%
$10 to $25 list	—10%
$25 to $50 list	—14%
	Low Grade
Less than $10 list	—5%
$10 to $25 list	—16%
$25 to $50 list	24%

SWITCHES, SNAP AND FLUSH

5-Amp. and 10-Amp., 125-Volt Snap Switches

	Std. Pkg.	List
5-amp. single-pole	250	$0.28
5-amp. single-pole, ind.	250	.32
10-amp. single-pole	100	.48
10-amp. single-pole, ind.	100	.54
5-amp. three-point	100	.54
10-amp. three-point	50	.76
10-amp., 250-volt, D. P.	100	.66

SWITCHES, SNAP AND FLUSH—Cont'd

10-Amp. 250-Volt Push-Button Switches

	Std. Pkg.	List
10-amp. single-pole	100	$0.45
10-amp. three-way	50	.70
10-amp. double-pole	50	.70

DISCOUNT—NEW YORK

Less than 1/5 std. pkg.	List
1/5 to std. pkg.	15%
Std. pkg.	28%

DISCOUNT—CHICAGO

Less than 1/5 std. pkg.	+20% to list
1/5 to std. pkg.	List to —15%
Std. pkg.	List to 30%

SWITCH BOXES, SECTIONAL CONDUIT

Union and Similar—	List Each
No. 155	$0.34
No. 160	.60

DISCOUNT—NEW YORK

	Black	Galvanized
Less than $2.00 list	List	Net
$2.00 to $10.00 list	10% to 20%	5%
$10.00 to $50.00 list	20% to 30%	15%

DISCOUNT—CHICAGO

	Black	Galvanized
Less than $2.00 list	25%	20%
$2.00 to $10.00 list	25%	20%
$10.00 to $50.00 list	25%	20%

TOASTERS, UPRIGHT

NEW YORK

List price	$6.00
Discount	30%

CHICAGO

List price	$5.50 to $6.00
Discount	25% to 30%

WIRE, ANNUNCIATOR

NET PRICE—NEW YORK

	Per Lb. Net
No. 18, less than full spools	$0.44¼
No. 18, full spools	0.43¼

CHICAGO

	Per Lb. Net
No. 18, less than full spools	$0.57½ to $0.64
No. 18, full spools	0.50½ to 0.54

WIRE, RUBBER-COVERED, N. C.

Solid-Conductor, Single-Braid

NEW YORK

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 1000 Ft.	1000 to 5000 Ft.
11.	$15.00-$18.00	$13.00	$11.25-$11.50
12.	23.25- 25.41	21.30- 21.78	15.97- 19.35
10.	32.40- 35.21	29.70- 30.18	22.13- 27.00
8.	45.70- 49.12	41.90- 42.12	30.88- 38.00
6.	72.40- 77.84	66.35- 66.72	48.93- 60.30

CHICAGO

	Price per 1000 Ft. Net		
No.	Less than 500 Ft.	500 to 2500 Ft.	2500 to 5000 Ft.
14.	$18.00	$13.00-$13.50	$11.50-$12.00
12.	25.33-$26.28	22.48- 25.33	20.40- 20.93
10.	30.04- 36.54	30.03- 31.26	22.23- 29.23
8.	48.97- 51.51	41.36- 41.98	39.42- 41.36
6.	66.46- 88.38	62.43- 70.70	56.39- 70.70

WIRE, WEATHERPROOF

Solid-Conductor, Triple-Braid, Size 4/0 to 8 Inc.

NEW YORK

	Per 100 Lb. Net
Less than 25 lb.	$33.25 to $35.25
25 to 50 lb.	31.25
50 to 100 lb.	28.25 to 34.25

CHICAGO

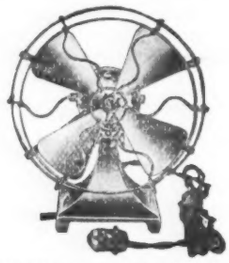
	Per 100 Lb. Net
Less than 25 lb.	$40.35
25 to 50 lb.	39.35
50 to 100 lb.	38.35

NEW APPARATUS & APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

The New Features of 1918 Fan Designs

CHANGES in the line of fans offered to the trade for 1918 consist almost entirely of the elimination of those types that have been in less demand and which have been discontinued with a view to concentrating manufacturing effort and available supplies of materials on the types of fans most needed. Few new fans will be placed on



HAMILTON-BEACH FAN EQUIPPED WITH AIR-COOLED MOTOR

the market this year. Virtually all six-blade fans have been replaced by the four-blade type except in the larger alternating-current oscillatory fans. The absence of speed controllers, highly polished parts and other refinements not necessary for reliability is noteworthy. The more important changes in design follow:

Carleton Company, Boston, Mass.—This company will continue to specialize in battery fans of any voltage. This year, except on oscillating fans, a universal ball-and-socket joint will be used instead of the regular hinged joint.

Century Electric Company, St. Louis, Mo. — Minor improvements have been made in several of this company's models, but these changes are not sufficient to change the general appearance. This company's 9-in. (22.9-cm.) fans, which were described in the Jan. 27, 1917, issue of the ELECTRICAL WORLD, were not produced in a large quantity and will be featured this season.

Emerson Electric Manufacturing Company, St. Louis, Mo.—This company has discontinued the non-oscillating six-blade residence-type fan for alternating current and direct current, the six-blade direct-current oscillators, the 32-in. (81.3-cm.) sweep ornamental-type oxidized-copper-finish ceiling fan, and all of the ornamental-type ceiling fans previously offered with chain suspension. Six-blade residence-type fans will be made for 1918 in 12-in. and 16-in. (30.5-cm. and 40.6-cm.) alternating-current oscillating types only. A line of new model duplex rotary ceiling and column fans is listed for 1918, designed with careful consideration of the experience gained in the manufacture of these fans last season, it is said. This company's four-blade, 52-in. (132.1-cm.) sweep oxidized-copper-finish ornamental-type ceiling fan has been replaced by a new type, No. 42,641, equipped with 56-in. (142.2-cm.) sweep blades.

General Electric Company, Schenectady, N. Y.—One novel departure of this company's fans is in the finish, as all metal parts are now enameled a dark green and the blades are lacquered brass. All of these fans are readily adjustable for either desk or bracket use. They are furnished with standard cords and plugs.

The complete line of General Electric Company's fans for this season will include 9-in., 12-in. and 16-in. (22.9-cm., 30.5-cm., and 40.6-cm.) oscillating and non-oscillating four-blade fans in both direct and alternating current. Six-

WESTINGHOUSE FAN FROM WHICH USUAL REFINEMENTS HAVE BEEN OMITTED

blade oscillating fans in 12-in. and 16-in. sizes are made for alternating current only.

Ventilating fans for 1918 will be handled in 12-in. and 16-in. sizes, six blades, in both alternating current and direct current. These fans, finished in green enamel, with lacquered brass blades and trimmings can also be furnished with special bearings to operate in a vertical position.

In standardizing to three sizes of desk and ceiling fans the company's engineers feel that they have provided a fan suitable for every use.

A. C. Gilbert Company, New Haven, Conn. — Several mechanical changes have been made in the Polar Cub fan made by this company. The speed-control handle, which was found to be too long, has been shortened, the motor is nickel-plated and the guard and blades are finished in black japan. This company has added a 9-in. (22.9-cm.) oscillating, four-blade fan, equipped with a universal motor, to its line.

Hamilton-Beach Manufacturing Company, Racine, Wis.—This company announces its Cyclone universal fan, equipped with the H-B universal air-cooled motor, wound to operate on both direct and alternating current at a voltage of from 105 to 120, 60 cycles. This fan is equipped with a rheostat speed control giving five different speeds and shut-off. It has an extra-heavy base which effectually prevents its creeping, and its design readily permits of its use either as a desk or wall-bracket type.

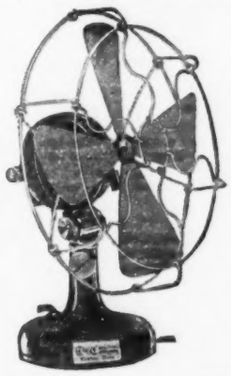
Knapp Electric & Novelty Company, New York City.—This company has added a new fuse to its line, an 8-in. (20.3-cm.) 110-volt fan equipped with a universal motor. The fan is finished in brass and black japan and equipped with 6 ft. (1.8 m.) of cord and plug. Only minor changes have been made in the fans that were marketed last year.

Menominee Electric Manufacturing Company, Menominee, Mich.—This company makes the announcement that its 1918 fan-motor line will not include any radical changes or any entirely new models. It has discontinued temporarily a few of the special patented types, such as the horizon-

WESTERN ELECTRIC 6-IN. FAN

tal table fan and socket fan, which were principally for the foreign market. It is announced that this company's type 150 8-in. (20.3-cm.) universal straight-type low-priced fan can be had this year with or without a three-speed

rheostat in the base. When without, the fan retains the usual type number of 150, but with the three-speed rheostat in the base the type number is 164. The 8-in. (20.2-cm.) oscillator has been redesigned, substituting die casting for



CARLETON FAN EQUIPPED WITH UNIVERSAL BALL-AND-SOCKET JOINT

cast iron. On the 12-in. and 16-in. (30.5-cm. and 40.6-cm.) types the brass guard holders are being omitted. Both guards and guard holders will be black enameled steel, and, as usual, the blades will be of polished brass.

Pittsburgh Electric Specialties Company, New York City.—This company has brought out an improved 8-in. and 10-in. (20.3-cm. and 25.4-cm.) fan of the oscillating type that is finished in black japan with brass blades, adjustable for desk or wall use. These fans have three speed regulations and may be used either as straight or oscillating fans. They are equipped with cord and plug and universal motor.

Sprague Electric Works of General Electric Company, New York City.—Aside from improvements in minor details of construction, the only change made in this company's fan-motor line is the substitution of a blade finished in brass lacquer on its 12-in. and 16-in. (30.5-cm. and 40.6-cm.) fans for the blade finished in black enamel which was used last season. The guard, as well as the motor body and base, will continue to be finished in black enamel.

Western Electric Company, New York City.—The specifications for this company's line for the coming season conform in most particulars to those of the 1917 line, the most noteworthy change being the finish of its 6-in. (15.2-cm.) fan, which will be dark green. As standard for 1918, a 6-in. fan to be operated only on alternating-current circuits and another to operate only on direct-current circuits will be marketed.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.—Concentration on those models whose serviceability and popularity have been amply tested has been the aim of the 1918 changes in the line of fans made by the Westinghouse Electric & Manufacturing Company. Where both four-blade and six-blade fans have been offered the six-blade fans have been eliminated and some of the less popular ceiling fans have been withdrawn.

All portable fans are provided with a hinge joint to adapt them to mounting on either desk or wall. The oscillating mechanism can be adjusted for a "swing" of from 45 deg. to 90 deg. at the rate of eight per minute, or can be locked out of service entirely. A tilt of 20 deg. from horizontal can also be had.

The Westinghouse Whirlwind, an 8-in. (20.3-cm.) fan at a popular price, has the drawn-steel construction characteristic of Westinghouse fans. From it have been omitted, however, such refinements as speed control, highly polished blades and others not necessary for durability. Current can be cut off by separating the attachment plug.

The remainder of the portable line includes both oscillating and non-oscillating fans of 10, 12 and 16-in. (25.4, 30.4 and 40.6-cm.) diameters. Ten-inch fans have zinc-plated, polished and lacquered blades; 12-in. and 16-in. models have polished and lacquered brass blades. The finish of all other parts is dull black. All models are packed in substantial boxes and include attachment plug and 8 ft. (2.4 m.) of cord.

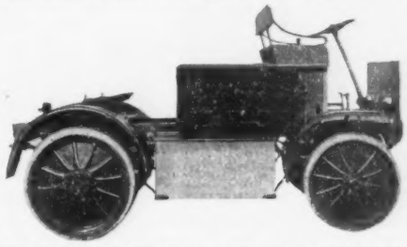
MENOMINEE FAN WITHOUT RHEOSTAT IN BASE

Reports from the Other Manufacturers.—The following manufacturers report only slight changes in fans for the coming season: Dilg Manufacturing & Trading Company, New York City; H. Boker & Company, Inc., New York City; Fidelity Electric Company, Lancaster, Pa.; Manhattan Electrical Supply Company, Inc., New York City; Crocker-Wheeler Company, Ampere, N. J.; Eck Dynamo & Motor Company, Belleville, N. J.; Star Electric Motor Company, Newark, N. J.; Racine Universal Motor Company, Chicago, Ill.; Robbins & Myers Company, Springfield, Ohio; Adams-Bagnall Electric Company, Cleveland, Ohio; Lindstrom-Smith Company, Chicago, Ill., and Hunter Fan & Motor Company, New York City. The Shedd Electric Company, Inc., of Roselle Park, N. J., announce that it does not expect to manufacture any fans this season.

The Peerless Electric Company, Warren, Ohio; Crucet Manufacturing Company, New York City; Dayton Fan & Motor Company, Dayton, Ohio; American Electric Fan Company, Logansport, Ind.; Kokomo Oscillating Fan Company, Kokomo, Ind., and Russell Electric Company, Chicago, Ill., have made developments in fans which are not available at this time, but will be described in later issues of the ELECTRICAL WORLD.

Electric Tractor

Electric tractors that are especially valuable for haulage between buildings of large manufacturing plants and similar places are made by the Walker Vehicle Company of Chicago. Tractors are made with hauling capacities up to 15 tons gross trailing load, the one shown here having a hauling capac-



VALUABLE FOR HAULAGE IN MANUFACTURING PLANTS

ity of 10 tons. It is pointed out that the large-diameter wheels of these tractors make them especially valuable on rough pavements. The Walker balance drive used in these tractors is extremely simple, durable and efficient, it is said. A sixty-cell Edison type A-12 battery is used.

Concrete Lighting Posts

The accompanying illustrations represent a part of the line of concrete posts for lighting boulevards, streets and parks made by the Chicago Concrete Post Company of Chicago. All of these are ornamental in appearance, pleasing in design and made to withstand severe and varying climatic conditions. It is said that these posts are not affected by either the heat of summer or the cold and ice of winter. The post heights are from 8 ft. to 13 ft. (2.4 m. to 4 m.), exclusive of globe holder.

The posts are one solid shaft, made in water-tight cast-iron molds, and are

THREE TYPES OF CONCRETE POSTS

each reinforced with four twisted "rail carbon" steel rods. The reinforcing rods extend about 18 in. (45.7 cm.) below the base of the post, and by inserting rods in the foundation the use of anchor bolts is eliminated.

Trade Notes

M. A. B. STEIN has resigned as New England representative of Harvey Hubbell, Inc., to take up work in the cantonment division of the Quartermaster's Department of the army at Washington.

THE CROCKER-WHEELER COMPANY of Ampere, N. J., announces that Ben D. Christian and D. B. Graze will hereafter represent it on the selling staff at Cleveland, Ohio, succeeding Howard Dingle and W. W. Clark.

THE STANDARD ELECTRIC & ELEVATOR COMPANY, Inc., of Baltimore, Md., has been reorganized and is offering $100,000 of 7 per cent cumulative preference stock for public subscription. The money realized though this stock issue is to be applied to the development of the company's physical facilities necessary to present demands.

THE WAR TRADE BOARD, Washington, D. C., in an official announcement, states that henceforth a new export application form will be used in place of all forms hitherto in existence. It will be the only application form in use. Copies of the blanks, with information pertaining to their use and other pertinent directions, may be had on application to the board.

THE DAYTON ENGINEERING LABORATORIES COMPANY of Dayton, Ohio, is now occupying its new buildings, greatly facilitating the output of Delco-light products. In all there are 135,000 sq. ft. of floor space. The three buildings are single-story structures of the monitor type, thus insuring uniform lighting and ventilation. The general offices of the company remain at the old address.

THE GENERAL ELECTRIC COMPANY, Harrison, N. J., has commenced the erection of a large new plant on Cross Street for the manufacture of glass bulbs, and the work is progressing favorably. The company is also planning for the erection of an addition and alterations at its plant at 268 North Nineteenth Street, East Orange, and has taken out a building permit for this purpose.

THE NATIONAL ASSOCIATION OF MANUFACTURERS of New York City, through its foreign department, has published an interesting pamphlet entitled "An Export Order," with a description of an effective agency for promoting the foreign trade of American manufacturers. Various approved forms of correspondence, invoices, packages, etc., are embodied. Copies may be obtained by writing.

H. W. STORTZ, for many years with the Edison Storage Battery Company, Orange, N. J., during which he served as sales manager of the mine lamp department, sales manager of the industrial truck and tractor department and sales manager of the house-lighting department, has resigned to become vice-president and general sales manager of the Swartz Electric Company of Indianapolis, Ind., manufacturer of automatic lighting plants.

THE MECHANICS AND METALS NATIONAL BANK of New York City has prepared a booklet, which is being sent to banks and business organizations throughout the country, outlining a plan for converting non-essential industries of the nation to a war basis on a gradual instead of a drastic scale. It is entitled "Steps to Victory" and described as a "brief discussion of the things to do and the things to do without during the progress of the war."

THE MAXWELL ENGINEERING & MANUFACTURING COMPANY of New York City succeeds to the business of Hickey & Schneider, dissolved, manufacturers of electrical specialties, transmission line equipment, transmission line hardware and outdoor and indoor substations. The new company is established at 61 Broadway. Mr. Maxwell, president and general manager of the company, was for the past five years sales agent for the H. & S. line.

THE IRVING NATIONAL BANK of New York City has published several pamphlets written by Lewis E. Pierson, chairman of the board of directors, entitled respectively "The Trade Acceptance Nationally Launched," "Government Price Fixing and Profit Taxation" and "War Time Finance." A fourth pamphlet, "The Influence of the War on Trade, Domestic and Foreign," is by G. A. O'Reilly, the bank's foreign trade representative. Copies may be had by application.

THE ELECTRICAL ENGINEERS' EQUIPMENT COMPANY of Chicago announces the removal of its general offices and a portion of the manufacturing departments to 710-714 West Madison Street. This new location is directly opposite the company's present quarters, at 711-715 West Meridian Street. The major portion of the factory proper, together with the shipping and stock departments, will remain at the latter address, which is connected to the Madison Street building by means of a runway.

THE PATTON-MACGUYER COMPANY, Providence, R. I., is the new corporation name of what was formerly the Bliss-Chester Company, manufacturer of brass stampings, of that city. The location and nature of the business will be substantially the same as before. The executive officers are: Ralph C. Patton, president; Charles L. Patton, vice-president, and Herman F. MacGuyer, secretary and treasurer. R. C. Patton was formerly chief engineer of the D & W Fuse Company, Providence, R. I., and Mr. MacGuyer special sales representative.

THE DRIVER-HARRIS COMPANY, Harrison, N. J., had a fire in its factory last week, which destroyed two of the buildings used for storage of raw materials and finished stock, machinery, chemical laboratory, testing room, one of the shipping rooms and one of the wire-spooling departments and the electrical cord and wiring insulating department. Suspension in shipment of materials affected by this fire, the company states, will only be temporary. More than half of the machinery required for electrical cord production and other required new equipment has been purchased and is now on the way to the factory. Temporary quarters have been provided.

New Incorporations

THE BUNYAN SIGNAL LIGHT COMPANY of Cleveland, Ohio, has been chartered with a capital stock of $20,000 by W. J. Bunyan and Andrew Heppel.

THE STANDARD WIRE COMPANY of Harrison, N. J., has been incorporated with a capital stock of $50,000 to manufacture wire for electrical and other service.

THE ELECTRICAL ENGINEERING COMPANY of Pittsburgh, Pa., has been incorporated with a capital stock of $30,000 by Thomas G. Hodgson and others.

THE JERSEY CITY (N. J.) AUTO ELECTRIC COMPANY has been organized to operate an electrical repair plant at 279½ Fairmount Avenue. R. Kaiser is one of the incorporators.

THE FRANCO BATTERY COMPANY of St. Mary's, Pa., has been incorporated with a capital stock of $250,000 by Lyle G. Hall and others. The company proposes to manufacture electric batteries.

THE AUTOMATIC RAILWAY COMPANY of New York, N. Y., has been chartered with a capital stock of $14,500 by L. H. Washburn, C. K. Allen and J. S. Wooster, 115 Broadway, New York City.

THE ELECTRICAL ENGINEERING COMPANY of Pittsburgh, Pa., has been chartered with a capital stock of $30,000 by Thomas G. Hodgdon. The company proposes to do a general engineering business.

THE ELECTRIC APPLIANCE COMPANY of Pittsburgh, Pa., has been incorporated with a capital stock of $25,000 to manufacture electrical appliances. The incorporators are A. A. Meagher and others.

THE HARRIS POPP ELECTRIC COMPANY of Charleston, W. Va., has been chartered by A. Nornoff, T. H. and Thomas Popp. The company is capitalized at $10,000 and proposes to manufacture electric fixtures.

MARCUS & COMPANY of Boston, Mass., has been incorporated by Israel H. Marcus, Edward A. Thomas of Winthrop and Daniel F. Cunningham of Brighton. The company is capitalized at $50,000 and proposes to deal in electrical supplies.

THE RURAL LIGHT & POWER COMPANY of Louisville, Ky., has been incorporated with a capital stock of $15,000 by W. R. Katterjohn, A. H. and R. M. Thompson. The company proposes to install and operate electric-lighting and power plants.

THE ASHLAND (ME.) ELECTRIC COMPANY has been incorporated by G. H. Mooers, L. C. Mooers and W. L. Waldron of Ashland. The company is capitalized at $50,000 and proposes to generate and distribute electricity for lamps and motors.

THE DOMESTIC ELECTRIC EXPORT COMPANY of New York, N. Y., has been incorporated with a capital stock of $200,000 to do a general import and export business and deal in manufactured articles. The incorporators are A. H. Gleson, J. J. Hayden and D. Barnett, 258 Broadway.

Trade Publications

PIPE PUSHER.—The Easy Manufacturing Company of David City, Neb., is distributing a bulletin descriptive of its "Easy" pipe pusher.

FLUSH RECEPTACLE. — Harvey Hubbell, Inc., of Bridgeport, Conn., is distributing bulletin 16-3, descriptive of its Hubbell flush receptacle with adjustable aligning plate.

FANS.—The Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York City, has prepared a leaflet descriptive of its fans for 110-volt and battery service.

INSTRUMENT TRANSFORMERS.—Bulletin 46,013, descriptive of switchboard-type instrument transformers, is being distributed by the General Electric Company of Schenectady, N. Y.

AUTOMATIC RAILWAY SUBSTATIONS. —The Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., has prepared leaflet 3998, descriptive of its automatic railway substations.

INDUSTRIAL TRUCKS AND TRACTORS.—Electric storage battery industrial trucks and tractors are illustrated and described in catalog No. 117 prepared by the Elwell-Parker Electric Company of Cleveland, Ohio.

CONVEYOR.—The Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has just issued an eight-page booklet (known as booklet W) illustrating and describing the C-H dispatch conveyor, which is particularly adapted for newspaper and magazine publishing plants. It is designed for taking papers from the press (regardless of the press speed) and delivering the folded papers in the mailing room. The booklet also gives a list of representative papers using the conveyor. The flexibility of this dispatch conveyor permits turning at any angle, vertical or horizontal, to avoid obstructions. It may be run overhead, down through the floor or straight away.

RESISTANCE MATERIAL. — The Electrical Alloy Company, 135 Broadway, New York City, has just issued its new edition bulletin catalog No. 9, which contains much useful information on its complete line of electrical resistance materials, nickel alloys, pure nickel and electrical alloy grade "A" monel metal. The book will be of extreme interest to all engineers, and particularly to those in the electrical and automobile industries. It is pointed out by the Electrical Alloy Company in its catalog that each electrical alloy product has been standardized only after repeated and exhaustive tests by its staff of electrical and metallurgical engineers, and also that its complete line embodies a resistance material for each resistance requirement.

BAKELITE MICARTA GEARS.—Technical information regarding Bakelite Micarta-D gears is contained in a pamphlet recently published by the Westinghouse Electric & Manufacturing Company of East Pittsburgh. The distinctive features of this material for noiseless gears and pinions are listed, together with its physical properties. Methods of turning and drilling and gear cutting are described and illustrated with many halftones and drawings. Methods of attaching to the driving shaft which have proved suitable for gear of all sizes are shown and tables of pitch, teeth and other gear data are also given. There are formulas for the horsepower rating, the amount of power which can be transmitted through press fit and for calculating other variables in gear practices.

METERS.—Users of gas in large quantities, such as steel mills, gas companies and others, will be interested in knowing that the Cutler-Hammer Manufacturing Company of Milwaukee, Wis., has just issued an eight-page booklet (known as booklet T) illustrating and describing the Thomas meter for the accurate commercial measurement of gases and air in large quantities. The booklet gives the principle of operation, illustrates essential parts and shows typical installations. The Thomas meter is different from all other forms of gas meters capable of measuring large quantities of gas in that it gives the quantities in standard units by which gas is bought and sold and does not require any corrections for temperature or pressure. Further, it shows a totalized result on an integrating meter and a graphic record of the rate of flow on a curve-drawing meter. The Thomas meter uses electricity as a means for measuring the quantity of gas and is a desirable load for the electric light company because under usual operating conditions it will have a high load factor and practically unity power factor.

New England States

BATH, ME.—The trustees of the Bath water district are considering the advisability of equipping the pumping station in Woolwich with electrically-operated machinery to replace the present steam power plant.

ASHLAND, N. H.—Improvements are being made to the municipal electric-light plant, including the installation of a 200-kw., three-phase, 60-cycle, 2300-volt Westinghouse turbo-generator set, and thirty-five 400-cp. luxolite lamps. L. G. Fifield is manager of power station.

BOSTON, MASS.—Bids will be received by the schoolhouse commissioners of the city of Boston, 1007 City Hall Annex, Boston, until Feb. 12 for construction of an elementary school, complete, in Roger Wolcott District, Harvard Street, Dorchester. A complete set of plans and specifications may be obtained upon a deposit of $25. A deposit of $15 will be required for a set of heating and ventilating or electrical plans with specifications.

GLOUCESTER, MASS.—The Council has granted the Gloucester Electric Company permission to erect pole lines on Winchester, Court, Warner and Burnham Streets in order to supply additional energy to the munitions plant, and also to provide more power to contemplated industries in the Maplewood section.

PALMER, MASS.—The Central Massachusetts Electric Company has petitioned the State Gas and Electric Light Commission for approval of an issue of additional capital stock of $200,000, the proceeds to be used to pay the cost of additions to its plant.

PROVIDENCE, R. I.—The Queen Dyeing Company, Valley Street, has awarded contract for the construction of a two-story addition to its power house, to cost about $7,000.

MERIDEN, CONN. — The Meriden Electric Light Company will install a 3000-kva. Westinghouse steam turbine in April for which necessary construction has been completed. Herman Minkwitz is superintendent.

Middle Atlantic States

BROOKLYN, N. Y.—Contract has been awarded by the Bureau of Yards and Docks, Navy Department, Washington, D. C., to the Marble Architecture Company, Broadway and 216th Street, New York City, for the construction of the proposed new power house at the local navy yard, to cost $225,000.

BUFFALO, N. Y.—The Public Service Commission has given its approval to the application of the Niagara, Lockport & Ontario Power Company to take over and operate the Salmon River Company.

BUFFALO, N. Y.—Plans have been prepared by the Sizer Forge Company, 238 Larkin Street, Buffalo, for several new buildings, including a machine shop, covered yard and machine and forge-shop in one group, to cost $112,000; brick forge-shop, $45,000; heat-treating plant, $87,000, and a three-story office building, to cost about $80,000. Plans for additional buildings to represent a total investment of $1,000,000, including the above, are under consideration by the company.

GLOVERSVILLE, N. Y.—Plans are being prepared by McKenzie, Voorhees & Gmelin, 1123 Broadway, New York City, for the construction of a new telephone exchange building, 30 ft. by 40 ft., for the Glenn Telephone Company.

ILION, N. Y.—The entire municipal electric-lighting system is being rebuilt. The work is now about half done. The work, it is expected, will be finished in about two years. C. S. Daily is manager.

MEDINA, N. Y.—The Western New York Utilities Company is contemplating the construction of a storage dam. G. W. Ide is superintendent.

NEW YORK, N. Y.—The United Electric Light & Power Company is constructing a condensing water intake tunnel connecting Harlem River with its generating station now under construction. During 1918 one 22,000-kw. turbo-generator unit, three-phase, 62½ cycles, 8000 volts, will be installed. L. A. Coleman is assistant secretary.

TULLY, N. Y.—Work is nearly completed on the installation of the new street-lighting system. Series 6.6-amp. lamps are being substituted for arc lamps. Louis C. Clay is chief engineer.

BAYONNE, N. J.—The New York Telephone Company is contemplating the construction of a one-story cable house on First Street, near Lord Avenue, for which permit has been granted.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

KEARNY, N. J.—Extensions and improvements to the electric fire-alarm system are under consideration by the Town Council.

NEWARK, N. J.—The Board of Freeholders has rescinded its contract for electric and power wiring in the laundry at the Essex County Hospital at Overbrook, recently awarded to the Beaver Engineering Company of Newark, at $14,174.

PLAINFIELD, N. J.—Steps will soon be taken by the board of governors of Muhlenberg Hospital for the installation of an electric plant in the hospital, to cost about $8,500.

TRENTON, N. J.—The State House Commission has announced that the construction of the proposed new electric plant at the New Jersey State Hospital has been temporarily postponed, due to the high cost of material, etc. The cost of the plant is estimated at $50,000.

WEST ORANGE, N. J.—The Town Council has approved an appropriation of $26,000 (in the annual budget) for electric street-lighting purposes.

DU BOIS, PA.—The Du Bois Electric & Traction Company has filed a notice with the Public Service Commission of an increase in capital stock of $49,000, the proceeds to be used for improvements, etc.

EMAUS, PA.—A number of important public improvements were recommended by Burgess Knauss in his annual message to the Council, including an ornamental lighting system, an improved fire-alarm system, street improvements, etc.

ERIE, PA.—Contract has been awarded by the Erie Forge Company, Fifteenth and Cascade Streets, for the construction of a new substation, about 50 ft. by 70 ft., to the Stader-Conrath Company of Erie.

LEWISTOWN, PA. — The Lewistown & Reedsville Electric Railway Company has filed notice with the Public Service Commission of an issue of $68,000 in bonds, to provide for extensions, improvements, etc.

PHILADELPHIA, PA.—Plans are being considered by the City Water Bureau for the erection of a new hydroelectric power plant at Fairmount. It is proposed to build a large dam in connection with the new power station.

SCRANTON, PA.—The Scranton Electric Company has purchased the plant and holdings of the Jenkins Township Light, Heat & Power Company.

BALTIMORE, MD.—A permit has been granted to the Consolidated Gas, Electric Light & Power Company to erect a power house, 60 ft. by 90 ft., at 25 Custom House Avenue, to cost about $65,000.

BALTIMORE, MD.—Plans have been filed and contract awarded by the Crown Electric Company, 149 North Gay Street, to L. Schoenlein, Jr., Guenther Building, Baltimore, for the erection of a two-story addition, 25 ft. by 80 ft., to its plant.

HAGERSTOWN, MD.—The Federal Milling & Refrigerating Company, recently incorporated with a capital stock of $300,000, is planning to install an ice plant. Electricity will be used as motive power. Orders, it is understood, have been placed for equipment.

SECURITY, MD. — The Hagerstown & Frederick Railway Company is now installing a 6250-kva. turbine at its Security station. M. A. Pooler is general manager.

BRISTOL, VA.—Plans are under consideration by the trustees of King College for the construction of a new power house, to cost about $30,000. C. B. Kearfoot of Bristol is architect.

NORFOLK, VA.—Plans have been prepared by the Packers' Architectural & Engineering Company of Chicago, Ill., and Wilson & Sompayrac, associated architects and engineers, Columbia, S. C., for constructing and equipping a cold storage plant on the water front for the Seaboard Ice & Cold Storage Company, consisting of main building, 400 ft. by 250 ft., 15 stories high; electric traveling cranes, eight elevators, dry storage building, 300 ft. by 72 ft., and power house, 96 ft. by 66 ft. The plant will be equipped for general cold storage and fish freezing. The cost of the plant is estimated at $1,899,000. Louis Feuerstein is president.

ROANOKE, VA.—John B. Guernsey & Company of Roanoke, it is reported, contemplate the construction of an electric plant for a mining camp at Rellim Siding, Va.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, has awarded contract for the installation of an electric-lighting system in the gun shop at the local navy yard to the White City Electric Company, 724 Ninth Street, N. W., Washington, at $12,900.

WASHINGTON, D. C.—The Bureau of Yards and Docks, Navy Department, has awarded to the Penn Seaboard Steel Corporation, Franklin Building, Pa., a contract for the installation of a 3000-kw. turbo-generator set at the navy yard, to cost about $56,385.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 25 for furnishing traveling cranes for the Washington Navy Yard, under specifications 2775. The cost is estimated at $600,000.

WASHINGTON, D. C. — Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 18 for furnishing and installing ten electrically-driven capstans at the navy yards at Norfolk, Va., and Philadelphia, Pa. Drawings and specifications (No. 2786) may be obtained upon application to the above bureau or to the commandants of the navy yards named.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Feb. 18 for fuel-oil heater, feed-water heaters, flow meters, tanks, reversing well equipment, coal gates, coal weighers, induced-draft fans, carbon-dioxide recorders and miscellaneous equipment at the navy yards, Norfolk, Va., and Philadelphia, Pa. Drawings and specifications (No. 2760) may be obtained on application to the above bureau or to the commandants of the navy yards named.

North Central States

CHARLEVOIX, MICH. — The city of Charlevoix has leased the plant of the Hydraulic Power & Light Company at Bellaire and contemplates installing a 200-hp. water wheel, one 350-hp. Skinner engine, one 500-hp. Corliss engine, one 200-hp. and one 300-hp. Stirling boiler; for auxiliary one 350-kw. Bullock, three-phase, 60-cycle, 2200-volt generator, and the erection of 28 miles of 23,000-volt transmission line. An auxiliary unit, consisting of a 120-hp. oil engine and a Westinghouse 90-kw., 2200-volt generator, is being installed at the Charlevoix plant. A. J. Hamilton is superintendent.

FLINT, MICH.—The local plant of the Commonwealth Power Company was recently damaged by fire, causing a loss of about $20,000.

CHARDON, OHIO.—At an election held Dec. 2 bonds to the amount of $25,000 were voted to rebuild and improve the municipal electric-light plant. It is proposed to change the system from 133 to 60 cycles and establish a day service and also to install a new electric-generating unit. Provision will be made to pump the city water as soon as installed, for which a $58,000 bond issue has been authorized.

LORAIN, OHIO.—Part of the plant of the H. Koppers Company of Lorain, including the machine shop, electrical department, tool room, etc., was recently destroyed by fire.

TOLEDO, OHIO.—The Acme Power Company, which is erecting a large power plant on the East Side, has increased its capital stock from $500,000 to $3,200,000. The plant, it is expected, will be placed in operation in the near future. The initial unit will have a generating capacity of 60,000 hp.

WELLINGTON, OHIO. — The Board of Trustees of Public Affairs is in the market for a flywheel of the following dimensions: 40 in. to 48 in. by 10 in. to 14 in., by 6-in. or 6½-in. bore, to weigh approximately 1000 lb. C. E. Gadfield is superintendent.

JACKSON, KY.—Preparations, it is reported, are being made by the Jackson Light & Ice Company to rebuild its electric plant, recently destroyed by fire.

LOUISVILLE, KY.—The Roy C. Whayne Supply Company of Louisville, it is reported, is in the market for single and double drum electrically-operated hoists, either for three-phase, 60-cycles, alternating current or for 220 to 250 volts direct current, and also for two and three-drum hoists, 7 in. by 10 in. or larger.

MAYFIELD, KY.—Bonds to the amount of $272,000 have been authorized for the purpose of taking over the water and lighting plants of the Mayfield Water & Light Company.

NEWPORT, KY.—Bids will be received by the Artesian Oil & Gas Company, Woolsack Building, Newport, until March 1 for pumping machinery to operate 3½ miles of 3-in. oil pipe lines.

OWENSBORO, KY.—A new 1875-kva. Westinghouse two-phase, 60-cycle, 2400-volt steam turbine is being installed in the municipal electric-light plant. William Watson is superintendent and chief engineer of the municipal electric plant.

INDIANAPOLIS, IND.—The Board of County Commissioners has signed a contract with the Merchants' Light & Heat Company of Indianapolis for supplying light and heat for the various county buildings for the year 1918.

MONTEREY, IND.—Plans are being prepared by Carl Nielsen, 154 West Randolph Street, Chicago, Ill., for the construction of a new power house, 50 ft. by 125 ft., one-story and basement, for the Monterey Electric Light & Power Company.

SCOTT, IND.—The town of Scottsburg is now installing a new system to supply electricity for commercial purposes.

WILLIAMSPORT, IND. — Improvements are contemplated to the municipal electric-light plant, including the installation of a three-phase generating unit (directly connected) to replace the single-phase unit now in use. A new switchboard is now being installed. R. B. Rodman is superintendent.

AURORA, ILL.—The Illinois Public Utilities Commission has granted the Western United Gas & Electric Company permission to issue $180,000 in bonds.

CANTON, ILL.—Application has been made to the State Utilities Commission by the Canton Gas & Electric Company for authority to erect high-tension transmission lines. William H. Parlin is president.

HARTFORD, WIS.—The purchase of a 500-hp. water tube boiler to supplement the three boilers (total capacity 450 hp.) in the municipal electric-light and power plant is under consideration. The present boiler house will also be enlarged. Definite plans have not yet been decided upon.

LOWELL, WIS.—The Lowell Light & Power Company is planning the erection of 8 miles of electric transmission lines, work on which will begin in the spring. Webster F. Pease is manager.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company contemplates extending its lines a distance of about 5 miles.

DULUTH, MINN.—The Duluth Edison Electric Company is completing the installation of two-phase and three-phase feeder-panel addition to switchboard and the installation of five additional single-phase feeder regulators, making 14 in service. C. W. Higgins is assistant manager and chief engineer.

PINE CITY, MINN.—The Eastern Minnesota Power Company contemplates the installation of a 500-kw. steam turbine, also developing a water power of approximately 1000 hp., which will include 10 miles of electric transmission line to connect with its present plant. R. P. Allen is manager.

ALBIA, IOWA.—The Albia Light & Railway Company is rebuilding its plant, work on which is nearly completed.

DES MOINES, IOWA.—Plans for extensions and improvements to the system of the Des Moines City Railway Company, providing for an expenditure of about $300,000 this year, will be submitted to the City Council.

MADRID, IOWA.—Plans have been prepared by the People's Telephone Company for improvements to its system, to include a new or remodeled exchange building, new switchboard of the common-battery type and improvements to the telephone lines.

MAQUOKETA, IOWA.—The Iowa Electric Company is extending its 33,000-volt transmission lines to Anamosa. A 300-kw. General Electric generator directly connected to a Buckeye cross-compound engine has been recently installed in the local power plant. John Drabelle is electrical engineer.

MARSHALLTOWN, IOWA. — Improvements are contemplated to the municipal electric-light plant, including the installation of a new 150-kw. generating unit and extensions to the overhead transmission system.

BOWLING GREEN, MO. — Extensions and improvements have been made to the system of the Pike County Electric Light & Power Company, including the erection of 11 miles of electric transmission lines. Mrs. D'Arline Holcomb is president.

ELDORADO SPRINGS, MO.—The Missouri Valley Light & Power Company has purchased another generating unit, consisting of a three-phase, 60-cycle, 2300-volt generator directly connected to a Russell compound engine, to be installed in April. C. C. Arthalong is superintendent.

LEWISTOWN, MO. — H. H. Bronson, owner of the local electric-light plant, is contemplating the installation of direct-current generator and meters.

MARSHFIELD, MO.—The plant of the Marshfield Electric Company is being overhauled and among the improvements contemplated is the installation of an additional generating unit and the establishment of a day service. Karl Keesy is general manager.

ST. LOUIS, MO.—Plans have been prepared by Charles H. Wray, architect, Rialto Building, for the construction of a hospital at Grand and Shaw Avenues, for the Missouri Pacific Railway Company, to cost about $3,000,000. The plans provide for the installation of a refrigerating plant, boilers, engine, generator, pumps, etc. Bids, it is understood, will be asked for after Feb. 10.

SPRINGFIELD, MO.—Improvements involving an expenditure of from $15,000 to $20,000 are contemplated by the Springfield Ice & Refrigerating Company, which will include the installation of new machinery and the purchase of new equipment for the plant.

CAVALIER, N. D.—James Lang, owner of the local electric-light plant, expects to install an additional 35-hp. oil engine.

RAY, N. D.—The plant of the Ray Electric Company is being remodeled and enlarged. Oil storage tanks will be installed as soon as prices get back to normal. A. H. Meyer and R. W. Habein are owners.

BANCROFT, NEB.—The City Council is considering the installation of an electric-lighting system in Bancroft.

CLARKSON, NEB.—Extensions and improvements are contemplated to the municipal electric-light plant this summer to provide for an 18-hour service. L. J. Roubineck is superintendent.

LUSHTON, NEB. — Henry Garb, who owns a large farm near Lushton, is planning to construct an electric power plant on the Blue River to supply electricity in the town of Lushton and the farmers residing along the route of the transmission line.

OMAHA, NEB.—Bids, it is reported, are now being received by George B. Prince, Omaha National Bank Building, Omaha, for electric wiring, heating and plumbing of the new telephone building of the Nebraska Telephone Company, to be erected at Nineteenth and Douglas Streets, at a cost of about $750,000.

O'NEILL, NEB.—The McGinnis Creamery & Produce Company is contemplating the installation of a new 250-hp. boiler.

PENDER, NEB.—New machinery is being installed in the municipal electric-light plant. J. W. McCready is manager.

RED CLOUD, NEB.—The City Council is considering the erection of a smokestack at the municipal electric plant to cost about $1300.

ST. EDWARD, NEB.—The Nebraska Gas & Electric Company, Karbalk Building, Omaha, is now installing a new 75-hp. gasoline engine at its local plant. Mrs. P. B. Sargent is local manager. W. C. Ross of Omaha is general manager.

WAYNE, NEB.—New equipment is being installed in the municipal electric and water plant, including one Vilter Corliss engine, 14 in. by 30 in. and 75-kw., and one 37½-kw. three-phase, 60-cycle, 2300-volt generator. E. Murrill is manager.

WILSONVILLE, NEB.—Two new 7½-kw. transformers are being installed on the transmission lines of the municipal electric-light plant. A. L. Frederickson is superintendent.

ABILENE, KAN.—The Riverside Light, Power & Gas Company has nearly completed the installation of a 1250-kva. General Electric turbine at its plant. H. B. Gemmill is manager.

BALDWIN, KAN. — The transmission lines of the municipal electric light plant are being changed from direct to alternating current. A. W. Kirby is manager.

COLLYER, KAN.—The installation of an electric-light plant in Collyer is under consideration. For further information address Dr. LaCerte, editor of the *Collyer Advance*.

LEON, KAN.—Plans are being prepared by W. B. Rollins & Company, Railway Exchange Building, Kansas City, Mo., for a municipal electric-light plant in Leon, to cost about $15,000.

WELLSVILLE, KAN. — The Wellsville Electric Light, Power & Ice Company is contemplating the purchase of some 5 or 10-kva. transformers very soon. C. A. Smith is owner.

Southern States

NEWBERN, N. C.—Contracts have been placed by the city of Newbern with the General Electric Company for a 750-kw. Curtis turbine and with the C. H. Wheeler Company for a surface condenser for October delivery. When improvements are completed the plant will have a capacity of 1150 kw. The old 360-kw. outfit will be sold. F. G. Godfroy is superintendent.

ROCKY MOUNT, N. C.—Preparations are being made by the city of Rocky Mount for improvements to the municipal electric-light plant including the installation of a 300-hp. Heine type boiler, plans for which are now being prepared by J. N. Eley, Empire Building, Atlanta, Ga. The city also contemplates the purchase of a new generating unit at the gas plant, prices for which are now being asked for and contracts will be let within 60 or 90 days. The city would like to receive prices and other information on the proposed improvements. A. S. Lyon is superintendent of the municipal light plant.

WARRENTON, N. C.—The Warrenton Electric Light Company is planning to erect a three-phase, 2200-volt transmission line, using No. 4 wire, in the spring. The company will also connect 65 additional horsepower in motors for corn and flour mills, making a total of 261 hp. in motors connected. J. M. King is manager.

JOHNSTON, S. C. — The electric-light plant and ice factory of the Carolina Public Service Company has been purchased by F. M. Boyd, manager. The new owner proposes to install machinery for a flour and feed mill, to be operated in connection with the light and ice plant.

ALBANY, GA. — The Albany Power & Manufacturing Company is contemplating the installation of a 600-hp. water tube boiler, working pressure 185 lb., hand fired. E. S. Killebrew is superintendent.

BRUNSWICK, GA.—The Emergency Fleet Corporation has notified the Chamber of Commerce that at least 1000 houses will have to be erected at Brunswick within the next 60 days. All these houses, it is understood, will be wired for electric lighting.

DALLAS, GA.—Application has been made for a charter for the Dallas Utility Company to construct and operate electric-light and power plants to supply electricity for lighting towns and cities and to operate railroads and street car lines, etc. The company will be capitalized at $45,000 with the privilege of increasing it to not more than $100,000. R. D. Leonard, J. W. Hay and J. F. Welch are interested in the company.

SAVANNAH, GA.—Plans for the installation of an entire street-lighting system have been submitted to the City Council by L. A. S. Wood, illuminating engineer of the George S. Cutter Company of South Bend, Ind. Under the first plan the city is to install the necessary substation equipment, distributing system and lighting units, to be operated by the city, energy to be purchased in bulk; second, to replace the present arc-lamp lighting system with gas-filled or Mazda type "C" lamps; third, the abolition of the present ornamental cluster lamps on Broughton Street and the substitution of one-lamp posts. The cost of the first proposition is estimated at $65,427. The Savannah Electric Company has the contract for lighting the city, which does not expire for some time.

STATESBORO, GA.—A new 200-kw. General Electric turbo-generator is being installed in the municipal electric-light plant. The system will be changed from two to three phase. Daniel L. Gould is superintendent.

BONIFAY, FLA.—The City Council has engaged the J. B. McCrary Company of Atlanta, Ga., as engineer and contractor for the proposed electric-light plant and waterworks system. The cost of the work is estimated at about $21,000.

ST. PETERSBURG, FLA.—The St. Petersburg Lighting Company contemplates improvements to its plant, involving an expenditure of about $40,000.

HAMPTON, TENN.—J. H. Edens, it is reported, will rebuild the local electric-light plant, recently destroyed by fire.

HARRIMAN, TENN. — The Harriman Foundry & Machine Works has purchased the property of the Harriman Cotton Mills Company, which it will rebuild and equip to manufacture mining cars and contractors' equipment. The power plant in the mill will be dismantled and the plant equipped for electrical operation (individual motor drive). W. S. Baker is manager.

TUPELO, MISS. — New equipment, including a 100-hp. synchronous Westinghouse motor directly connected to a No. 5, two-stage Cameron steam turbine centrifugal pump is being installed in the mu-

nicipal electric-light and water plant. E. R. Chisholm is superintendent.

PINE BLUFF, ARK.—The Pine Bluff Company is now installing a 2500-kw., General Electric, three-phase, 60-cycle, 2300-volt generator. H. C. Couch is president.

CHANDLER, OKLA.—The Washita Electric Power Company, it is reported, will build a new power house, 50 ft. by 75 ft., in Chandler. The present equipment will be installed and new machinery, including a 150-hp. high-pressure boiler, a 150-hp. Corliss engine, directly connected to a three-phase, 60-cycle, 2300-volt generator will be added. The distribution will probably be overhauled and extensions made. For further information address R. K. Johnston of Pauls Valley.

CHECOTAH, OKLA. — The Checotah Water, Light & Ice Company is installing an additional electric generating unit, consisting of a 250-kw. Allis-Chalmers generator, a 350-hp. Monarch Corliss engine and three Atlas boilers, and other necessary equipment, to cost about $20,000. L. B. Griffing is secretary and manager.

AMARILLO, TEX. — The City Commissioners are considering calling an election to submit the proposal to issue $200,000 in bonds for the construction of a municipal electric-light plant.

BRYAN, TEX.—The City Commission has granted the Bryan Power Company a permit to erect an electric transmission line from the terminus of the city line to the oil plant of the Gulf Refining Company, which is outside of the city limits.

GALVESTON, TEX.—Bonds to the amount of $300,000 have been authorized, the proceeds to be used for lighting and other street improvements.

HEREFORD, TEX.—The Hereford Electric Light & Power Company is replacing a 120-hp. Corliss engine with a 160-hp. Skinner "Unaflow" engine, which will be installed within the next 60 days. The company is also installing a few 15-hp. motors for irrigation purposes. F. H. Oberthier is manager.

JEFFERSON, TEX.—The installation of electrical pumping equipment at the city pumping station is under consideration by the City Council.

LAMPASAS, TEX.—The Lampasas Light & Power Company is installing a pump connected to a 40-hp., three-phase motor to pump the city water, which will be completed in about 60 days.

SAN ANGELO, TEX.—The San Angelo Ice & Power Company contemplates improvements to its plant, involving an expenditure of about $10,000.

Pacific and Mountain States

ARLINGTON, WASH.—The plant of the Washington Coast Utilities Company, located near Arlington, has been put out of commission by recent floods. A new site, it is reported, must be selected.

CLE ELUM, WASH.—The Town Council has granted the town of South Cle Elum a franchise to construct and operate overhead and underground wires on certain streets in Cle Elum for the transmission of electricity for lamps, heaters and motors.

PE ELL, WASH.—The North Coast Power Company of Chehalis, it is reported, is contemplating extending its electric transmission lines from Pe Ell to Meskill.

PORT ORCHARD, WASH.—The Puget Sound Pulp & Power Company has petitioned the Commissioners of Kitsap County for a franchise to erect and operate electric transmission lines over the highways of the county for a period of 25 years.

SEATTLE, WASH.—Plans have been completed by the Puget Sound Traction, Light & Power Company for the superstructure of its proposed coal-pulverizing plant, adjoining the power station on Western Avenue and Seneca Street, to cost about $75,000.

SEATTLE, WASH.—The construction of a third unit at the Union Lake power plant, at an estimated cost of $600,000, in the immediate future, has been recommended by J. D. Ross, superintendent of lighting. The second unit, for which $390,000 was authorized, is nearing completion.

SEATTLE, WASH.—The City Light Department has made arrangements with the Stimson Mills Company to supply the department with 1500 kw. to assist in providing for the extra demand for power. An additional 600 kw. will be obtained from the small hydroelectric plant, which was built to utilize the excess water from the Volunteer Park reservoir, but which was never put to use.

TACOMA, WASH.—The city of Tacoma has entered into a contract with the American Nitrogen Products Company of La Grande to furnish electricity to operate the nitrogen plant of the company for a period of five years.

TACOMA, WASH.—The City Council has practically decided on the site near Mineral on which to erect the proposed new unit of the municipal power plant, to cost between $750,000 and $1,000,000. N. L. Taylor, engineer of the light department, has charge of boring test holes to locate bedrock at the site.

WINLOCK, WASH.—The Independent Electric Company has recently transferred its franchise to supply electricity for lamps and motors in Toledo, Winlock, Vader and Napavine to the Idaho-Washington Water, Light & Power Company. The new company will secure energy to operate its system from the power plant of the Winlock Lumber Company, about 1 mile south of Winlock.

EUGENE, ORE.—A report of the proposed improvements of the power plant at Walterville has been submitted by N. C. Nelson, engineer of the water and light board, which recommends the construction of a wing dam on the McKenzie River to develop 3000 hp. The plant now has a generating capacity of 2400 hp., and it is recommended that a gate be placed in the forebay to accommodate a second penstock later to supply a third unit. The plant is now built in two units.

GOLD HILL, ORE.—The Utah Mining Properties, located about 12 miles from Gold Hill, have been acquired by O. C. Runnalls of Seattle, Wash., and associates. The new owners contemplate the erection of an electric transmission line, about 5 miles long, to connect with the lines of the California-Oregon Power Company. It is proposed to equip the mines with electrically-operated machinery.

PORTLAND, ORE.—S. C. Jagger of the Morrison Electric Company, and J. H. Sroufe, formerly representative of the Ne-Page, McKenny Company of Seattle, it is reported, have secured a contract for electrical installation in 20 ships under construction for the Republic of France by the Foundation Company of Portland.

CALISTOGA, CAL.—The State Railroad Commission has authorized the Calistoga Electric Company to sell its electric distributing system in and about Calistoga to the California Telephone Company of Santa Rosa at $28,900.

DEL MAR, CAL.—Application has been filed with the State Railroad Commission by the San Diego Consolidated Gas & Electric Company asking for permission to purchase the distributing system of the Del Mar Water, Light & Power Company, at $11,037.

HANFORD, CAL.—The People's Ditch Company of Hanford, it is reported, is considering the construction of a new electric-light and power plant for local service.

LODI, CAL. — Among the improvements contemplated to the municipal electric-lighting system are the installation of voltage regulators and additional one-lamp electroliers. John A. Henning is superintendent.

LOS ANGELES, CAL. — The Southern California Edison Company has applied to the Board of Supervisors for a franchise to erect and operate electric transmission lines throughout the entire country for a period of 40 years.

LOS ANGELES, CAL.—Two applications involving proposed expenditures of over $1,000,000 have been filed with the State Railroad Commission by the Southern California Edison Company. One involves the impounding of the waters of Pitman Creek in Fresno County and the other the waters of Salmon and Horse Creeks in Tulare County. It is proposed to store the waters of Pitman Creek and divert a portion of same to Big Basin reservoir, on Big Creek, and the remainder directly into conduits leading to power plants below. The cost of dam and conduit line to Big Basin Reservoir is estimated at $842,900. The Salmon and Horse Creeks project provides for the construction of a reservoir with a capacity of 14,049 acre-ft. This diversion is supplementary to a previous one and is intended to augment the supply delivered to Kern River power plant No. 3 during the period from August to December of each year.

PALO ALTO, CAL.—Work has begun on the new electric plant to be erected in what are known as the "corporation yards" on the Stanford Campus near the new University Press Building. It will change the center of electrical distribution from the station underneath the law building on the inner quadrangle.

PITTSBURG, CAL.—The State Corporation Commissioner has granted the Great Western Electro Chemical Company permission to sell 7000 shares of capital stock, the proceeds to be used for extensions to its plant in Pittsburgh.

REDDING, CAL.—The electric power plant, planing mill and boiler house of the Shasta Land & Timber Company of Redding, it is reported, was recently destroyed by fire, causing a loss of about $50,000.

RIVERSIDE, CAL.—The transmission lines of the municipal electric-light plant will soon be extended to the municipal rock crusher at the end of Central Avenue.

SAN FRANCISCO, CAL.—The Asher Electrical Company, 607 Howard Street, San Francisco, has been awarded the contract for the installation of a street-lighting system and the interior wiring of the barracks buildings at the camp at Angel Island.

KINGMAN, ARIZ.—J. B. Girand has resigned his position as city engineer, it is reported, to devote his entire time to the project of building a large dam in the Grand Canyon at Diamond Canyon. Preliminary work has been completed and work on construction of dam will begin as soon as spring floods subside. Electricity generated at the proposed plant, it is stated, will be used in connection with equipping the Santa Fé Railroad between Needles and Winslow for electrical operation.

ABSAROKEE, MONT.—The hydroelectric power plant of the Absarokee Power Company will be completed and placed in operation in about a month. Edward R. Reber is manager.

HAMILTON, MONT. — The Missoula (Mont.) Light & Water Company has offered to sell its water-works system in Hamilton to the city for $75,000.

WOLF POINT, MONT.—The local electric-light plant has been purchased by J. E. Galehouse of Carrington and C. B. Aasness of Bismarck, N. D.

DENVER, COL.—The Nevada-California Power Company, it is reported, is contemplating erecting a high-tension transmission line from its power plant on Bishop Creek, Cal., to Reno, Nev., to supply electricity to the large mining camps of Nevada, the Owens Valley, Imperial Valley and Arizona districts.

BATTLE MOUNTAIN, NEV. — The Nevada Valleys Power Company of Lovelocks has taken over the local plant. Work will begin at once for the installation of a 130-hp. engine. When improvements are completed a day motor service will be established. W. W. Mason will have charge of the system in Battle Mountain.

LAS CRUCES, N. M.—The construction of a hydroelectric plant as part of the Elephant Butte reclamation project is advocated by the Rio Grande Water Users' Association. Dr. Nathan Boyd of Las Cruces is at the head of a committee which is promoting the project.

Canada

CHILLIWACK, B. C.—The city of Chilliwack was recently cut off from all power, light, telephone and telegraph service and water supply by storms. About six weeks, it is estimated, will be required to put the electric-light and power system in operation.

CHESLEY, ONT. — The Chesley Chair Company is reported to be in the market for a number of electric motors of from 5 to 30 hp.

COPPER CLIFF, ONT. — The Canada Copper Company, it is reported, is in the market for an electrically-driven pump, 150 gal. per minute capacity, mine pump head of 1100 ft., discharge 6 in., and a 100-hp. alternating-current, 550-volt, direct-driven motor.

TORONTO, ONT.—The general contract for the construction of a boiler house to be erected at the plant of the Swift Canadian Company has been awarded to the John V. Gray Construction Company.

MONTREAL, QUE.—The Southern Canada Power Company, Christine Building, Montreal, is contemplating the erection of about 100 miles of high-tension transmission line and has asked for tenders on poles, cross-arm braces, wire and other material for same. C. A. Haskell is purchasing agent.

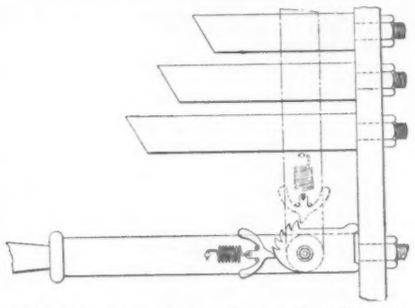
Miscellaneous

JUNEAU, ALASKA.—The Union Power Company, recently incorporated, has acquired property for the construction of a hydroelectric power plant in Willow Creek district. An electric transmission line, about 12 miles long, will be erected to reach the neighboring mining properties.

(Issued Jan. 8, 1918.)

1,252,633. ELECTRIC FURNACE; Carl H. Von Baur, Douglaston, N. Y. App. filed Aug. 6, 1917. Imperforate bottom and provided with electrodes connected with a two-phase, three-wire system of electric-current distribution.

1,252,635. ELECTRIC ORE FURNACE; John A. Ward, Spokane, Wash. App. filed April 12, 1917. Means for closely and continuously regulating the heat of electric coils used in such furnaces.



1,253,286—Restraining Device for Electric Switches

1,252,661. ELECTRIC WATER HEATER; Howard K. Clover, Los Angeles, Cal. App. filed May 23, 1917. Stream or jet of water may be heated as it passes through and issues from the heater.

1,252,739. REVERSING SWITCH FOR ELEVATOR MOTORS; John E. Thompson and Clarence W. Jameson, Chicago, Ill. App. filed Nov. 1, 1915. Improvement.

1,252,809. APPARATUS FOR ELECTRIC WELDING; Charles H. Kicklighter, Atlanta, Ga. App. filed Jan. 26, 1914. Apparatus for electrically welding seams of various kinds in plate and sheet-metal work.

1,252,813. BAKING OVEN; Frederick S. Kochendorfer, Chicago, Ill. App. filed Nov. 11, 1916. For baking incandescent-lamp filaments.

1,252,826. VIBRATORY ACTUATOR; Edwin H. Messiter, Brooklyn, N. Y. App. filed Aug. 15, 1914. Provides an electro-responsive oscillatory actuator that shall be adapted to effect a step-by-step rotative movement of a driven member.

1,252,838. ELECTRIC SWITCH; William T. Pringle, Wyncote, Pa. App. filed Jan. 20, 1915. Knife switches.

1,252,897. RECIPROCATING MECHANISM AND SYSTEM OF MOTOR CONTROL THEREFOR; Walter Foster, Plainfield, N. J. App. filed Feb. 11, 1913. Relates to mechanisms having reciprocating tables and reversing motors connected with the tables to drive them.

1,252,902. CONTROL SYSTEM; Clark T. Henderson, Milwaukee, Wis. App. filed July 3, 1916. Applies particularly to braking systems for printing presses and other machines having a high inertia.

1,253,046. CONDUIT FOR ELECTRICAL CONDUCTORS; Joseph A. Kennedy, Pawtucket, R. I. App. filed Feb. 24, 1917. Flexible.

1,253,063. MOTOR-CONTROLLING APPARATUS; David L. Lindquist and David C. Larson, Yonkers, N. Y. App. filed July 7, 1914. Adapted to hand-rope-control alternating-current elevators.

1,253,157. REVERSIBLE BRUSH HOLDER FOR USE WITH DYNAMOS; John L. Creveling, New York, N. Y. App. filed Aug. 7, 1911. Means for satisfactorily compensating for reversals in rotation of the armature.

1,253,194. SELECTOR RELAY; Allen B. Kendall, Elizabeth, N. J. App. filed May 20, 1916. Improvements.

1,253,198. WELDING CONTROLLER; Theodore D. Montgomery and Leroy C. Schantz, East Orange, N. J. App. filed July 21, 1916. In which the power supply to the electrodes is limited when the resistance of the arc is small.

(Issued Jan. 15, 1918.)

1,253,201. TEMPERATURE-REGULATING DEVICE; Carl N. Auel, Wilkinsburg, Pa. App. filed March 30, 1914. Applied particularly to devices for controlling the admission of a fluid to a burner for the purpose of maintaining a uniform temperature.

1,253,204. ELECTRICAL MEASURING INSTRUMENT; William M. Bradshaw, Wilkinsburg, Pa. App. filed April 15, 1914. Induction type.

1,253,207. ELECTRICAL PROTECTIVE DEVICE; Harold W. Brown, Ithaca, N. Y. App. filed Dec. 19, 1913. Relays.

Record of Electrical Patents

Notes on United States Patents

1,253,208. RAILWAY SIGNALING SYSTEM; Carl H. Buhl, Cleveland, Ohio. App. filed July 22, 1912. Improvements.

1,253,210. CONTACT MAKING AND BREAKING DEVICE; Lewis W. Chubb, Edgewood Park, Pa. App. filed May 3, 1915. Relatively movable contact terminals of an interrupting device may be relieved of injurious burning or arcing and of the resultant depositing and pitting.

1,253,211. ELECTRICAL TESTING DEVICE; Lewis W. Chubb, Edgewood Park, Pa. App. filed Feb. 4, 1916. For testing high-voltage insulators.

1,253,212. ELECTRICAL MEASURING INSTRUMENT; Lewis W. Chubb, Pittsburgh, Pa. App. filed Feb. 7, 1916. For indicating the crest or maximum values of voltage waves having any frequency.

1,253,213. CONTROL APPARATUS; John A. Clarke, Jr., Wilkinsburg, Pa. App. filed Dec. 18, 1914. For use in electric railway vehicles and the like.

1,253,223. CATHODE STRUCTURE FOR VAPOR CONVERTERS; Sidney W. Farnsworth, Pittsburgh, Pa. App. filed May 3, 1916. Improvements.

1,253,235. CONTROL APPARATUS; Arthur J. Hall, Wilkinsburg, Pa. App. filed June 8, 1916. Liquid rheostats.

1,253,242. FIELD-COIL SUPPORT; Fielder I. Hiss, Wilkinsburg, Pa. App. filed Sept. 28, 1912. For machines of the compound-wound type.

1,253,253. ELECTRIC HEATING ELEMENT; Sherman L. Kelly, Toledo, Ohio. App. filed Oct. 23, 1916. Open-air heating type for use in ovens of electric stoves.

1,253,265. BRUSH FOR ELECTRICAL APPARATUS; Samuel C. McKeown, Newark, N. J. App. filed Oct. 18, 1916. Applies particularly to the type of brush used in high-tension distributers.

1,253,267. RECTIFYING SYSTEM; Friedrich W. Meyer, Pittsburgh, Pa. App. filed June 20, 1914. Provides means whereby energy from a plurality of alternating-current circuits of different voltages and of different frequencies may be rectified and supplied to a like number of direct-current circuits having correspondng voltages.

1,253,275. POLYPHASE REACTANCE COIL; John F. Peters, Edgewood Park, Pa. App. filed April 5, 1917. The coils are superposed upon one another and connected in circuit in such manner that they are mutually inductively related.

1,253,282. COMBINED LAMP AND BATTERY TESTER; Gustav Ruckardt, New Hampton, Iowa. App. filed Jan. 27, 1917. Improvements.

1,253,286. RESTRAINING DEVICE FOR ELECTRIC SWITCHES; Albert E. Sierad, Pittsburgh, Pa. App. filed Aug. 7, 1914. Means for preventing the opening of electrical switches until a predetermined closed position has been reached.

1,253,296. PULL SOCKET FOR ELECTRIC LAMPS; Samuel Starus, New York, N. Y. App. filed June 3, 1916. Improvements.

1,253,297. ELECTRICAL MEASURING INSTRUMENT; Harold B. Taylor, Wilkinsburg, Pa. App. filed Sept. 25, 1914. Power-factor meters.

1,253,305. MEASURING INSTRUMENT; Rees E. Tulloss, Cambridge, Mass. App. filed June 25, 1917. Provides a measuring device specially adapted for use in connection with typewriting machines to measure and make records of the exact times of depression of the typewriter keys.

1,253,385. SIGNAL SYSTEM FOR ELECTRIC CARS; Elmer M. Jones, Atlanta, Ga. App. filed Aug. 21, 1913. Provides an effective system of automatic signals and car control for electric railroads employing a trolley or third-rail.

1,253,409. ELECTROMAGNET; David W. Martin and Robert F. Thompson, Schenectady, N. Y. App. filed Jan. 23, 1917. Provision of means whereby the chattering of the movable member of the magnet due to alternations in the circuit is prevented in a simple and efficient manner.

1,253,533. SOUND-TRANSMITTING APPARATUS; Harrison W. Rogers, New York, N. Y. App. filed April 19, 1916. Means for controlling a pneumatic sound box.

1,253,572. ELECTRODE FOR ELECTRIC-ARC LAMPS; Frank Buchanan, Syracuse, N. Y. App. filed Oct. 20, 1909. Designed to be used in places where there is vibration tending to jar the electrodes loose.

1,253,657. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Jr., Brooklyn, N. Y. App. filed June 10, 1916. Improved circuit arrangement for associatng the operator's telephone set with and disconnecting the same from the connecting circuits.

1,253,659. SWITCHING APPARATUS; Christian Aalborg, Wilkinsburg, Pa. App. filed Dec. 26, 1913. Provides a group switch which shall embody a plurality of complete, self-contained and independent unit switches assembled in side-by-side relation.

1,253,660. SWITCHING APPARATUS; Christian Aalborg, Wilkinsburg, Pa. App. filed Dec. 26, 1913. Employed in connection with control systems for railway motors.

1,253,671. TELEPHONE-EXCHANGE SYSTEM; Henry P. Clausen, Mount Vernon, N. Y. App. filed April 12, 1917. Provides a system by means of which the time of completing connections between telephone lines is reduced to a minimum and in which more satisfactory service is rendered to the subscribers.

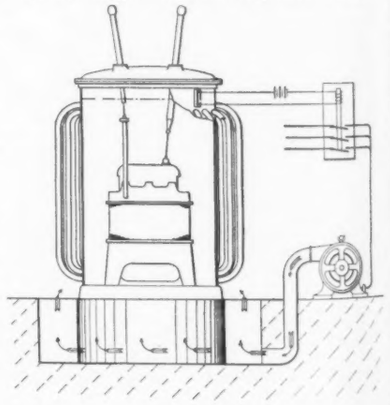
1,253,684. TELEPHONE-EXCHANGE SYSTEM; Charles L. Goodrum, New York, N. Y. App. filed Dec. 30, 1916. To enable a calling party in a large system to get his connection without the necessity of remembering a large number of digits while operating his finger wheel.

1,253,688. TELEPHONE EXCHANGE; Myron F. Hill, Boston, Mass. App. filed March 24, 1908. The reduction of the wiring and apparatus and the resulting simplificaton of the exchange.

1,253,698. AUTOMATIC SWITCHING MECHANISM; Frank A. Lundquist, New York, N. Y. App. filed Dec. 2, 1916. Provides a switch in which one only of several idle trunks that may be found simultaneously by a plurality of brushes will be used, the remaining idle trunks found being left free to be selected by other switches.

1,253,703. SEMI-AUTOMATIC TELEPHONE TRUNKING SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Sept. 13, 1907. Provision of an arrangement for enabling the subscribers of a private exchange to communicate with the subscribers of a main exchange.

1,253,732. ELECTRIC FURNACE-CONTROL APPARATUS; John A. Seede, Schenectady, N. Y. App. filed June 21, 1917. Arc.



1,254,002—Transformer Heat-Regulating System

1,253,761. CIRCUIT BREAKER; Richard Wolfsbger and Sidney C. Smith, Los Angeles, Cal. App. filed April 4, 1917. To insure the safety from electric shock of the person operating the circuit breaker.

1,253,765. LAMP; Alfred C. Abramson, Rockford, Ill. App. filed March 6, 1917. Pedestal.

1,254,002. TRANSFORMER HEAT-REGULATING SYSTEM; Charles S. Cook, Pittsburgh, Pa., and Harold H. Rudd, Edgewood, Pa. App. filed Jan. 23, 1914. For electrical power transformers of large capacity.